Mission Report

The provision of technical assistance to the Ghana Statistical Service with regard to Census Mapping and GIS

Prepared by:

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Prepared for:

The GSS and the World Bank, General Data Dissemination System, Socio-Demographic Statistics Project for Anglophone Africa

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1. Introduction

The Ghana Statistical Service (GSS) is currently involved in the planning for the next Population Census which will be taking place during March, 2010.

The GSS needs technical assistance regarding the implementation of modern census methodology, the use of satellite imagery for census mapping as well as the successful implementation and use of Geographic Information Systems (GIS) to drive the whole process, including all the ancillary issues that are implicated, such as staffing, equipment, software and infrastructure.

Moreover technical assistance is needed regarding the sustainability and maintenance of the GIS, specifically with regard to training and skills transfer.

The GSS attended the GDDS 2 GIS Module launch workshop in Accra, Ghana during the end of May,2007 where they, in conjunction with the lead consultant, drew up their Country Work Plan regarding the deliverance of three technical assistance missions covering three country identified priorities.

As noted, the technical assistance has been divided into three missions, this document being the mission report on the second mission.

The specific objectives, activities and deliverables for this mission was detailed in the Terms of Reference which is included in Annexure 1. The GSS's general objective regarding GIS is to develop and implement a sustainable GIS which can act as a corporate service provider to the statistical agency in the long term while short term objectives are to implement a successful census mapping and support methodology.

The basic objectives and deliverables for this mission are however stated below.

Specific issues to be covered during the consultancy were the following:

- Monitoring and evaluation of census mapping activities
- Monitoring and evaluation of imagery usage and database creation
- On-site monitoring and evaluation, assessment of current activities and rectification of possible errors
- Assessment and evaluation of type of imagery acquired thus far and assistance in acquisition of reputable quotations where necessary.
- Focus on specific subject matter training and skills transfer
- Assistance in infrastructure planning and data integration
- Assist the GSS in creating a Master data warehouse (geodatabase) containing all available vector and raster data
- Assist the GSS in the integration of datasets from different coordinate systems
- Evaluate and assess newly acquired infrastructure.
- Subject matter training in:
    - Geodatabase creation
    - Data integration techniques
    - Fieldwork methodology and GPS use (optional)
    - Map creation and production

Specific outputs:

- Assessed current activities
- Assessment report
- Imagery evaluation report
- Skilled and trained staff in the subject matter fields specified above.
- Comprehensive supporting documentation and training materials

- Created and functional geodatabase at the GIS Unit
- Documented next steps and action plan to address any critical issues

2. Implementation of the consultancy

The mission was implemented by Mr. Francois Bezuidenhout from **Geospace International**. As specified in the ToR, the total mission time was 10 days on site at the GSS with two additional days for preparation and report writing. The second mission ran from the 18th to the 28th of August.

3. Acknowledgements

The consultant would like to thank the Government Statistician of the GSS, Dr. Grace Bediako, the Head of the Field Operations and GIS division, Mr. Henry Nii Odai, the Section Head of Geographic Planning and Field Operations, Mr. Andrews Lamtey and in particular the Section Head of the GIS Unit, Ms. Rosalind Quartey for their support and cooperation during the consultancy. Special thanks to all the staff at the Field Operations and GIS Division for their enthusiasm, assistance and positive attitude. The consultant would also like to thank the GDDS Project of the World Bank for sponsoring the consultancy.

4. Program context

With financial support from the Department for International Development (DFID) of the United Kingdom, the World Bank is implementing a project to assist 21 Anglophone Africa countries to participate in the General Data Dissemination System (GDDS). Participating countries are being assisted to participate in the GDDS through two separate, but linked projects both financed by DFID. The IMF is providing project management and technical support in the area of economic and financial statistics. The World Bank is providing technical support in the area of socio-demographic statistics. Both projects run concurrently until February 2010.

Technical assistance is being provided through the World Bank to help countries implement plans for improvement in population, health, agriculture, labor market, justice and security, management of statistical systems, GIS and small area statistics. The GDDS framework developed by the IMF provides the framework for the detailed elaboration of long-term statistical development strategies. Participating countries have already expressed their requests for technical assistance and both the IMF and the World Bank have developed their assistance strategies. Ghana was one of the countries which asked for technical assistance in the field of GIS and small area statistics.

5. Assessment of progress made regarding Census Mapping since the last mission

The previous GDDS mission took place during the last two weeks of January, 2008, approximately 7 months ago. Progress made by the GSS with regards to census mapping since the last mission is disappointing. The reasons for the lack of progress will be discussed later on, but first we will determine which positive progress has been made thus far. Following are the main actions that progress were made on.

- Fieldwork staff recruited, appointed and trained. The fieldwork staff training was completed in April 2008 and fieldwork commenced in June. Over 40 persons were recruited and trained and presently constitutes 10 fieldwork teams. These teams are currently in the field demarcation the northern regions district by district. Of the 168 districts, thus far 10 have been completed.
- UNFPA delivered some of the specified equipment, PC workstations and 20 Trimble Juno GPS units.
- There are plans in place to recruit and train fieldworkers in September for an additional 20 teams, increasing the total team compliment to 30.

- The current vehicle compliment is not sufficient but the vehicles used for the MIDA project will be released for census use as soon as the project ends in two months time. This will be a total of 15 vehicles.
- Digital imagery was acquired from the Survey Department covering the whole coastal area of Ghana up to 9km inland
- Most of the topographic and town plan vector information integration has been completed with two regions still outstanding.

The following list depicts actions which should have commenced by now, but was not implemented. Reasons will be discussed later on.

- Review and decide on an appropriate satellite imagery provision company. Appoint the relevant firm as soon as possible and draw up delivery schedule.
- Finalise the procurement for the additional hardware and software as specified in the GIS Situational Analysis and Infrastructure Assessment document.
- Finalise the Field Operations and GIS Unit staff training schedules and implement training.
- Acquire, process and integrate the first delivered satellite imagery into the GIS database
- Commence with census mapping activities for the areas covered with the coastal imagery. Ensure that at least 5 teams are seconded and trained for this process.

Although progress has been made in various areas, the GSS are currently running the risk of having too little time to complete census mapping activities. At the current pace and with the current resources and methodology, the GSS will not be able to complete accurate census mapping in time for the March 2010 deadline. What this lack of progress boils down to is that the GSS is facing a crisis regarding census mapping operations and ultimately, implementing the census itself.

5.1 Issues and Reasons

There are two interlinked issues which seem to be the route cause of all the delays and lack of implementation drive.

5.1.1 Lack of access to funding

Due to the fact that national elections are taking place later this year, as well as increased government expenditure regarding the oil bill introduced by the government, it seems as if government funding for census operations has taken a back seat. This is a typical scenario and not uncommon in some African countries that not enough funding is made available for census planning operations.

Consequently, sufficient funding was not available to implement many of the activities recommended by the consultant during the previous mission. Essential base map acquisition could not take place, the necessary census mapping database structures could not be developed and essential hardware and software could not be acquired.

Downstream logistics and procurement processes regarding the census operations as a whole as also being negatively affected.

Although the UNFPA have been engaged to provide certain equipment and consultancy services, it seems that donor agencies as a whole have not been sufficiently approached to assist with additional funding. The consequence is that there is no one to step in and fill the funding gap. This funding gap is currently causing delays in the whole census operations process and will ultimately lead to hasty and inaccurate census mapping and taking or to the census being postponed.

The irony is that the shorter the time available to implement census operations, the more it will cost. Financial resources needed to implement meaningful census mapping increases exponentially if to be implemented in a very short timeframe.

The Ghana GSS has unfortunately reached this point. Realistically, only 16 months are left to implement census mapping operations successfully. If the GSS wants to do it successfully, more financial and human resources would be needed that what was previously planned for. This also means revising the relevant donor documentation to reflect the increase in resources needed and engaging potential donors actively to secure funding.

It is critical that the relevant GSS senior management continuously engages on a face to face basis at the highest level with their counterparts at the Department of Finance so that they are constantly aware of the need for funding at the GSS. The GSS will also need to adjust their budget for the 2009 financial year so that sufficient provision is made for the census mapping and other downstream census operations.

Simply put, if sufficient funding is not acquired or pledged before the end of the year, it will be very difficult to adhere to the current deadline. Basically, it means that two scenarios will play itself out. In the first scenario, the census will still take place in March 2010, but census mapping would be a rush job which inevitably means inaccurate and shoddy work. This in turn will affect the accuracy of enumeration and analysis. The second scenario entails that the census is postponed to a later date to allow for the accurate completion of census mapping and more funding becoming available. Both of these scenarios will reflect negatively on the GSS and the Ghanaian government. They will be perceived by their peers as well as donors as not taking census operations seriously. Donors specifically will be less inclined to provide funding for future census operations. Moreover, downstream events such as national surveys and development planning will be negatively affected.

5.1.2 Lack of institutional drive

The consultant presented his view on the current census mapping status during the weekly Population and Housing Census planning meeting on the 21st of August. During the meeting it became clear that the GSS are facing certain coordination, communication and management issues which are causing as much delays in implementation as the lack of funding.

There seems to be confusion between line managers regarding responsibility and accountability protocols. Consequently, logistical processes which should be straight forward (such as the procurement of pencils) are being delayed since no one is taking coal face responsibility. Line managers seem to be reluctant to make any decision without the Government Statisticians explicit approval which is further causing delays.

The conducting of a census is a massive operation and every single operational decision cannot be ratified through one person. The GSS would need to review its current logistical, communication and procurement processes since they need to be streamlined and clarified.

In general, there seems to be a lack of implementation drive and initiative among senior and mid level managers and the Government Statistician conceded as much during the meeting. The meeting was honest and open and all concerned received and opportunity to air their views.

The conclusion was simple and was readily accepted. The conclusion was that the GSS management as a whole must take ownership of this census and must resolve the negative institutional processes hampering operational progress. They also realize that they themselves are the only ones who can resolve this issue since processes begins with people and only people can change processes.

Although the senior management has accepted their responsibility for this census and have indicated their willingness to take ownership, the proof of the pudding will be in the successful conclusion of the census.

It should be noted that all is not lost. There is still enough time to conduct successful census mapping operations before the deadline but action has to be taken now.

6. Liaison with senior management

After assessing the issues mentioned above, a meeting was arranged with the Government Statistician, Dr. Bediako to discuss said issues. A meeting took place on the 20th of August where the issues were discussed in detail. Dr. Bediako instructed the consultant to prepare a presentation on the census assessment findings and to present it at the weekly Population and Housing Census meeting the following day which would be attended by all the relevant divisional heads and senior management.

The consultant prepared the presentation and it was presented at the meeting on the 21st of August. The presentation can be found in Annexure 7. The meeting was very fruitful and it also gave the consultant the opportunity to assess management and communication dynamics within the organization.

The senior management was at consensus that the two main issues as discussed above, being lack of funding and implementation drive was negatively affecting census operational progress. A long question and answer session, followed by a discussion session took place where underlying reasons as well as possible solutions were probed.

The following decisions were made regarding these issues:

- It was decided to actively pursue additional funding from donors and development partners by way of drawing up and completing a donor document and holding a Donor Conference where the document can be presented. A task team was nominated to drive the process and was instructed to complete the donor document before the consultant's mission wads complete. The consultant was also asked to assist in this process which he did. The donor document was completed on the 28th of August and a draft copy can be found in Annexure 6. The donor conference will tentatively be planned for the latter part of September.
- During the meeting management did some self appraisal regarding the issues raised in terms of implementation drive, communication and accountability. A long discussion followed where collectively it was agreed that divisional heads and senior management needs to take responsibility for the census and resolve the bad communication and lack of accountability issues facing them. It was an open and frank discussion which allowed many repressed issues to come to the fore and these were discussed constructively.
- It was also decided to go ahead full steam with the planned increasing of the field teams and fieldwork capacity.

The consultant prepared a Census Mapping Assessment document in which the current status as well as remedial action and recommendations were provided to the GSS. The document was completed on the 27th of August and was presented to the Government Statistician during a meeting with her and selected staff and consultants where the salient issues were discussed. This document can be found in Annexure 5.

7. Overview of meetings and discussions

The following meetings and discussions took place:

Tuesday, 19th August

- An introductory meeting was held with Ms. Quartey who is the Unit Head of the GIS Unit in the Fieldwork Operations and GIS Division. During this meeting the schedule for the rest of the mission was discussed.
- Informal discussions was held with Ms. Quartey where the current status of the GIS Unit and its Census Mapping operations were discussed. A question and answer session followed where the consultant asked specific questions relating to the methodology and census mapping review.

Wednesday, 20th August

- Meeting with Dr. Bediako and Mr. Nyarko regarding current census mapping status and progress

Thursday, 21st August

- Attend the weekly Population and Housing Census 2010 (PHC) meeting during which a presentation is provided on the current census mapping status findings, issues and recommendations which is followed by a discussion of these issues. All the relevant senior management and division head were in attendance.

The following persons attended the meeting:

PARTICIPANT	DESIGNATION
Dr Grace Bediako	Government Statistician
Prof. N.N.N. Nsowah-Nuamah	Deputy Government Statistician
Mr. Baah Wadieh	Census Coordinator
Mr. Henry Nii Odai	Cartography
Mr. Andrwes Lamptey	Cartography
Mr. George Muller	Cartography
Mr. David Kombat	Management and Administration
Mr Samuel Boakye	Management and Administration
Mr. Emmanuel Cobbinah	Management and Administration
Mr. Emmanuel Lamptey	Management and Administration
Mr. William Addey	Management and Administration
Mr. Emmanuel Larbi	Management and Administration
Mr. Kofi Agyeman-Duah	Planning and Analysis
Mrs. Emma Sepah	Planning and Analysis
Mr. Gershon Togoh	Planning and Analysis
Mr. Johnson Kagya	Planning and Analysis
Mr. Odei Gyebi	Planning and Analysis
Ms. Sarah Woode	Planning and Analysis
Mr. Martin Poku	Field Operations
Mr. Sylvester Gyamfi	Field Operations
Mr. Nkansa Yentumi	Field Operations
Mr. Peter Pepra	Field Operations
Mr. Joseph Okantey	Field Operations
Mr. R Appia Kusi Boateng	Data Processing
Mr Charles Cartey	Sampling
Mr. Francis Yankey	Sampling
Mr. Anthony Amuzu	Sampling

Mrs. Araba Forson	Sampling
Mr. Opoku-Manu Asare	Publicity and Dissemination
Mr. Titus Quartey	Publicity and Dissemination
Mr. Ebenezer Ocran	Publicity and Dissemination
Mr. Emmanuel Brown	Publicity and Dissemination
Mrs. Abena Osei Akoto	Data Processing
Mr. K.B. Dansu-Manu	Data Processing
Mr. Isaac Boamah	Publicity and Dissemination
Mr. Anthony Amuzu	Publicity and Dissemination
Mrs. Faustina Ainguah	Demography
Mrs. Edith Mote	Planning and Analysis
Ms. Rosalind Quartey	Cartography
Mr. Emmanuel Larbi	Cartography
Mr. Magnus Duncan	Planning and Analysis
Mrs. Jacqueline Anum	Data Processing
Mr. Francis Dzah	Agriculture
Mr. Lawrence Adwonum-Darko	Consultant
Mr. Thomas J. Amantey	Consultant

Tuesday, 26th August
Meeting with the two local consultants, Mr. Lawrence Adwonum-Darko and Mr. Thomas J. Amantey where the use of GIS and imagery in census operations was explained to them followed by a discussion on various methodological issues.

Wednesday, 27th August
Debriefing meeting with the Government Statistician, the head of the GIS Unit, Ms. Quartey and one of the local consultants, Mr. Thomas Amantey. The mission activities, findings and recommendations were discussed as well specific actions regarding the way forward.

8. Overview of technical assistance provided

8.1 Assessment of current census mapping progress, activities and workflow

This was the first activity to which the consultant paid attention to. Current census mapping status was assessed after which a meeting was held with the Government Statistician regarding this issue. The GS requested the consultant to prepare a presentation and present his findings and recommendations to the weekly PHC 2010 meeting attended by all the senior management as well as the divisional heads. As noted, the presentation proved to be a "rude awakening" (as the GS put it), for the senior management staff regarding the difficulties it faces in making the Census 2010 deadline. Specific outputs emanating from the meeting has already been discussed. The Census Mapping Assessment document with recommendations and a way forward action plan was completed and presented to the relevant parties. The consultant also assisted the appointed task team with the creation of the Donor document to be used at the Donor conference.

8.2 Newly acquired imagery operations

The GIS Unit managed to obtain digital aerial photography for the entire coastline of Ghana up to 9km inland. These image files were however very large and were untilled with no overviews. The consultant consequently compressed and processed these images to allow for more efficient GIS operations.

8.3 Assistance in the projection conversion of current vector datasets

Additional town plan and topographic vector data was integrated and merged by the GIS Unit, however, due to an outdated projection system, these datasets needs to be reprojected to fit the

current database. The same goes for the coastal imagery. The consultant began with the building of a spatial data warehouse containing one coordinate system and most of the coastline data was completed, allowing the GIS Unit to continue with their urban census mapping efforts. The consultant will take the data for the rest of the country with him to complete the total data warehouse in time for the November mission, since it is a lot of data of which some needs specialized software to do the re-projections. This additional work will be done free of charge.

The idea is that when the consultant returns in November the entire data warehouse would be ready and the consultant can then provide the GIS Unit with the necessary training on how to create the resultant geo database. Preliminary training in the creation of the data warehouses have already been provided, and the GIS Unit can continue with the urban mapping operations in the mean time as specified in the Census Mapping Assessment document, providing the necessary hardware is acquired.

8.4 Training

8.4.1 GPS Data integration and conversion training

The GSS acquired 20 Trimble Juno GPS receivers of which 10 are currently active in the field. The consultant provided training to the GIS staff on how to integrate the downloaded information into the Trimble Pathfinder software and how to use the software to convert the captured information to GIS ready shape and Access files. The consultant also provided training on how to integrate the GPS information with the current demarcation data warehouse.

The current data dictionary they are using in the field was reviewed and a new data dictionary was created. Training was provided on how to use the Pathfinder software to create and edit data dictionaries as well as how to load it onto the GPS units. Training was also provided in relevant editing functions as well as the GPS receiver data capturing setup.

8.4.2 Fieldwork methodology and office demarcation training

Training was provided to the GIS Unit as well as the Cartographic Unit staff regarding fieldwork methodology using imagery. The most appropriate fieldwork methodology for the Ghanaian situation was discussed and formulated during the initial training. Consequently, specific fieldwork areas were identified and photo maps were created of these areas. The necessary 2000 Census sketch map and EA information was acquired and the staff spent two days in the field doing field map exercises.

At the end of each day they returned to the office where further training was provided on how to digitize and integrate the information captured in the field onto the GIS. The specific Census 2010 digitising warehouse characteristics was discussed and three separate digitising warehouses were created which would house the different types of newly created data. A further two days was spent by the staff on practicing digitizing techniques.

The staff is therefore able to continue with the urban demarcation operations when the consultant leaves providing the necessary hardware is acquired as specified in the Census Mapping Assessment document.

One of the mission directives for the third mission in November would be to assess the work done by the GIS Unit regarding the demarcation operations and to provide further follow up training on specific issues identified by the unit staff themselves.

The following persons attended the training:

Name	Position
Rosalind Quartey	Senior Statistician, Head GIS Unit
Richard Gyimah Sasu	Statistician
Isaac Nyarko	Assistant Statistician
Richard Osei	National Service Personnel: Geography
Samual Baah – Boateng	National Service Personnel: Geodetic
Robertson Adjei	Field Operations Unit
Andrews Lamtey	Head: Geographic Planning and Field Operations
Kwao Akpeng	Survey Department Secondment
Ayerson Michael	Survey Department Secondment

9. Overview and assessment of problems and shortcomings encountered

9.1 Mission administration and schedule

Very few problematic issues was encountered during the mission itself. The GSS and GIS Unit staff was well prepared and was always available when the consultant needed them. They are well aware of the importance of GIS and Census Mapping for the success of the census as a whole and therefore provided assistance freely and participated enthusiastically and with skill.

9.2 Technical and methodological issues

Technical and methodological issues are discussed as part of the Census Mapping Assessment document and were also touched upon in the Donor assistance document, both of which can be found in the Annexure.

9.3 Institutional issues

The institutional issues regarding funding difficulties and the lack of implementation drive have been discussed in detail in the Census Mapping Assessment document.

10. Assessment of the way forward regarding methodology

The Census Mapping Assessment document provides further insight into the immediate short term implementation actions regarding the methodological implementation for the urban and rural areas. It was widely agreed with senior management that the GSS need to use a combination of modern and more traditional methods in order to reach the prescribed deadline within acceptable accuracy parameters. The rural areas are to be completed using the traditional method while the urban areas will be completed using a combination of satellite imagery and digital aerial photography. Details on these methodologies can be found in Section 5 of the Census Mapping Assessment document.

11. GSS Counterpart actions

The consultant's counterpart at the GSS is Ms. Rosalind Quartey. The counterpart's actions specified are to be implemented before the commencement of the third mission. The tentative timeline for the second mission is set for the 17th to the 28th of November 2008.

The following actions can be specified for the mission counterpart at the GSS:

- Obtain the necessary hardware (PC workstations, A3 printer, and server) and, most importantly, the high resolution satellite imagery for the selected urban areas.
- Pressurize the senior management to factor in the costs of the scenario sketched above into the line budget for the next two financial years.
- Continue with the traditional field operations in the rural areas
- Ensure that the rural demarcated maps are provided to the unit for digitizing by the map production and printing unit on a regular basis

- Continue with the integration and merging of the outstanding topographic map sheet and town plan data
- As soon as the small printer is fixed, schedule the fieldwork for Accra and the rest of the coastal areas and begin with the urban demarcation.
- Continue with the digitizing of demarcated rural and urban EAs as indicated using the relevant Census_2010_Master Warehouse.
- Continue with the downloading and conversion of GPS captured information and load it into the Census_2010_GPS_Warehouse.
- Ensure that the GIS staff obtains the necessary hands on experience in GIS operations and digitizing. Staff at Head office must be used optimally.
- Ensure that all the relevant software is procured and installed.
- Make regular follow-ups with senior management regarding any outstanding issues
- As each district is completed, ensure that the relevant district, SA and EA maps and created and printed and stored safely.

12. Deliverables

The following table depicts the expected deliverables, whether they were achieved or not and accompanying reasons.

DELIVERABLE	COMPLETED
Assessed current activities	Yes. The current census mapping activities was assessed. A presentation was provided to the GSS senior management and the Census Mapping Assessment and Donor Assistance document was completed
Assessment report	Yes. The Census Mapping Assessment report is included in the Annexure
Imagery evaluation report	Yes. The newly acquired imagery was evaluated as well as additional requirements. A report on the imagery requirements is part of the Census Mapping Assessment document
Skilled and trained staff in the subject matter fields as specified in the ToR	Yes. Staff was trained in all the relevant fields as specified in Section 8.4
Comprehensive supporting documentation and training materials	Yes. Training manuals was provided and existing manuals was updated and provided to the GIS Unit
Created and functional geodatabase at the GIS Unit	Yes. The digitizing warehouses have been developed and loaded
Documented next steps and action plan to address any critical issues	Yes. As part of the Census Mapping Assessment document

12.1 Additional Deliverables

This pertains to additional deliverables not specified for this mission.

- Assistance with the Donor Assistance document
- GPS data integration and data dictionary creation training

13. Annexes

13.1Annexure 1: Original Terms of Reference for Mission 1

General Data Dissemination System, (GDDS phase 2) Socio-Demographic Statistics Project for Anglophone Africa: Provision of technical assistance (Mission T2) as a lead expert for the topic (module) Geographic Information Systems to the Ghana Statistical Service (GSS), Accra.

Background

With financial support from the Department for International Development (DFID) of the United Kingdom, the World Bank is implementing a project to assist 21 Anglophone Africa countries to participate in the General Data Dissemination System (GDDS). Participating countries are being assisted to participate in the GDDS through two separate, but linked projects both financed by DFID. The IMF is providing project management and technical support in the area of economic and financial statistics. The World Bank is providing technical support in the area of socio-demographic statistics. Both projects run concurrently until February 2010.

Technical Assistance

Technical assistance is being provided through the World Bank to help countries implement plans for improvement in population, health, agriculture, labor market, justice and security, management of statistical systems, GIS and small area statistics. The GDDS framework developed by the IMF provides the framework for the detailed elaboration of long-term statistical development strategies. Participating countries have already expressed their requests for technical assistance and both the IMF and the World Bank have developed their assistance strategies. Ghana was one of the countries which asked for technical assistance in the field of GIS and small area statistics. The first mission (T1) was completed between the 21st of January and the 1st of February.

Terms of Reference
Background

The GSS attended the GDDS 2 GIS Module launch workshop in Accra, Ghana during the end of May, 2007 where they, in conjunction with the lead consultant, drew up their Country Work Plan regarding the deliverance of three technical assistance missions covering three country identified priorities. The purpose of the work plan is to act as a living document for the duration of the technical assistance and to serve as an information base from which the ToR for every mission can be drawn up. To this end, this ToR for the second mission to Ghana has been drawn up from the work plan, based on the expressed objectives of the chosen priorities, while additional priorities and deliverables is added due to changes in the immediate needs of the GSS.

It has been agreed that there are two types of reports. First there is the report of the consultant about the mission, secondly, the report of the staff of the GSS.
The consultant will assist the staff of the GSS to draft their report as part of the living document. Separately, the consultant has agreed to draft his own mission report. This report will use the format that will be provided in detail by the World Bank before the mission. It will comprise of: a) introduction, b) background, c) detailed agenda of all working days (in annex), d) description of the type of discussions, e) overview of all technical advises given, f) overview of problems and shortcomings encountered, g) overview of the own assessment of these issues, h) assessment of the way forward, i) list of recommendations of work to be done by the counterpart for the next period till the next visit, j) list of deliverables achieved/not achieved (and why), k) List of persons worked with for each of the days.

The GSS's long term objective is for GIS to act as a successful planning, implementation and monitoring tool through all the census processes and to instill the GIS Unit as a service provider for all the GSS line functions. In addition to this is the enhancement of the operations of the GIS Unit and improvement of the skills of its staff.

Purpose of the assignment

The purpose of the assignment would be to complete the second technical assistance mission at the Ghana Statistical Service. The next population census will take place in 2010 and the Ghana Statistical Service wants GIS to drive the Census Cartography process and to play an instrumental part in census data analysis and dissemination. The GSS also wants to expand and enhance the existing GIS Unit and improve the current staff skill levels. GDDS2 can provide the necessary technical assistance regarding these matters.

The mission will cover two pre-set priorities to varying degrees. These are:

- Priority 1: Digital Census Mapping
- Priority 2: Infrastructure implementation, database creation and training

Priority 1 will comprise 10% of the mission time and priority 2 will comprise 90% of the mission time. The total consultant time for the mission is 12 days divided as follow:

- 10 days actual mission time, can also be used in part for report writing
- 2 days consultant preparation and additional report writing time

Following are the objectives and planned activities by priority for the mission:

Priority 1

- Objectives
  - Monitoring and evaluation of census mapping activities
  - Monitoring and evaluation of imagery usage and database creation

- Activities
  - On-site monitoring and evaluation, assessment of current activities and rectification of possible errors
  - Assessment and evaluation of type of imagery acquired thus far and assistance in acquisition of reputable quotations where necessary.

Priority 2

- Objectives
  - Focus on specific subject matter training and skills transfer
  - Assistance in infrastructure planning and data integration

- Activities
  - Assist the GSS in creating a Master data warehouse (geodatabase) containing all available vector and raster data
  - Assist the GSS in the integration of datasets from different coordinate systems
  - Evaluate and assess newly acquired infrastructure.
  - Subject matter training in:
    - ArcGis 9.2 (if software is available)
    - Geodatabase creation
    - Data integration techniques
    - Fieldwork methodology and GPS use (optional)
    - Map creation and production

Skill requirements

The consultant would need relevant census mapping and GIS experience and skills within the African context and need to read and write English fluently. GIS experience needs to be hands-on and practical instead of purely theoretical.

Deliverables
The deliverables are listed by priority:

Deliverables for Priority 1:

- Assessed current activities
- Assessment report
- Imagery evaluation report

Deliverables for Priority 2:

- Skilled and trained staff in the subject matter fields specified above.
- Comprehensive supporting documentation and training materials
- Created and functional geodatabase at the GIS Unit
- Documented next steps and action plan to address any critical issues

A concluding Mission Report will form part of the final deliverable as well as a report by the GSS on the mission success and value.

Duration
As noted, the total consultant time for the mission is 12 days with 10 days mission time and 2 days preparation time.

Timing
To be completed from the 18th to the 29th of August 2008.

13.2 Annexure 2: List of Abbreviations and Acronyms

GSS	Ghana Statistical Service
EA	Enumeration Area
GIS	Geographic Information System
IT	Information Technology
GDDS	Global Data Dissemination System
IMF	International Monetary Fund
DFID	Department for International Development
GPS	Global Positioning System
GS	Government Statistician

13.3Annexure 3: List of Participants

Participants from the GSS

PARTICIPANT	DESIGNATION
Dr Grace Bediako	Government Statistician
Prof. N.N.N. Nsowah-Nuamah	Deputy Government Statistician
Mr. Baah Wadieh	Census Coordinator
Mr. Henry Nii Odai	Cartography
Mr. Andrwes Lamptey	Cartography
Mr. George Muller	Cartography
Mr. David Kombat	Management and Administration
Mr Samuel Boakye	Management and Administration
Mr. Emmanuel Cobbinah	Management and Administration
Mr. Emmanuel Lamptey	Management and Administration
Mr. William Addey	Management and Administration
Mr. Emmanuel Larbi	Management and Administration
Mr. Kofi Agyeman-Duah	Planning and Analysis
Mrs. Emma Sepah	Planning and Analysis
Mr. Gershon Togoh	Planning and Analysis
Mr. Johnson Kagya	Planning and Analysis
Mr. Odei Gyebi	Planning and Analysis
Ms. Sarah Woode	Planning and Analysis
Mr. Martin Poku	Field Operations
Mr. Sylvester Gyamfi	Field Operations
Mr. Nkansa Yentumi	Field Operations
Mr. Peter Pepra	Field Operations
Mr. Joseph Okantey	Field Operations
Mr. R Appia Kusi Boateng	Data Processing
Mr Charles Cartey	Sampling
Mr. Francis Yankey	Sampling
Mr. Anthony Amuzu	Sampling
Mrs. Araba Forson	Sampling
Mr. Opoku-Manu Asare	Publicity and Dissemination
Mr. Titus Quartey	Publicity and Dissemination
Mr. Ebenezer Ocran	Publicity and Dissemination
Mr. Emmanuel Brown	Publicity and Dissemination
Mrs. Abena Osei Akoto	Data Processing
Mr. K.B. Dansu-Manu	Data Processing
Mr. Isaac Boamah	Publicity and Dissemination
Mr. Anthony Amuzu	Publicity and Dissemination
Mrs. Faustina Ainguah	Demography
Mrs. Edith Mote	Planning and Analysis
Ms. Rosalind Quartey	Cartography
Mr. Emmanuel Larbi	Cartography
Mr. Magnus Duncan	Planning and Analysis
Mrs. Jacqueline Anum	Data Processing
Mr. Francis Dzah	Agriculture
Mr. Lawrence Adwonum-Darko	Consultant
Mr. Ayerson Michael	Survey Department Secondment
Mr. Kwao Akpeng	Survey Department Secondment

Mr. Robertson Adjei	Field Operations Unit
Mr. Samual Baah – Boateng	National Service Personnel: Geodetic
Mr. Richard Osei	National Service Personnel: Geography
Mr. Isaac Nyarko	Assistant Statistician
Mr. Richard Gyimah Sasu	Statistician
Mr. Thomas J. Amantey	Consultant

13.4Annexure 4: Mission Schedule

TIME	ACTIVITY
Tuesday, 19 August	
8h00 – 9h00	Arrive at GSS. Welcome and Introductions
9h45 – 10h30	Staff meeting, discuss mission schedule
10h30 – 13h00	Assess current census mapping progress and workflow
13h00 – 14h00	Lunch
14h00 – 17h00	Assess current GPS data dictionary. Create new dictionary with input from staff. Provide training in GPS data download, conversion and GIS integration.
Wednesday, 20 August	
8h00 – 9h00	Meeting with the Government Statistician, Dr. Bediako, to discuss census mapping progress
9h00 – 13h00	Re-projection and integration of newly acquired vector topographic and town plan data and imagery
13h00 – 14h00	Lunch
14h00 – 16h00	Compression, tiling and creation of overviews for newly acquired imagery
16h00 – 20h00	Creation of presentation to the PHC Secretariat Weekly Meeting
Thursday, 21 August	
8h00 – 10h00	Creation of master warehouse demarcation database
10h00 – 14h00	Attending PHC Secretariat weekly meeting and presenting census mapping assessment findings and recommendations. Discussion follows afterwards.
14h00 – 17h00	Creation and refinement of master demarcation warehouse. Further processing of available imagery.
Friday, 22 August	
8h00 – 13h00	Providing training to the GIS Unit and the Field Operations Unit in GIS software use revised fieldwork methodology. Discuss and determine fieldwork processes.
13h00 – 14h00	Lunch
14h00 – 15h00	Providing training to the GIS Unit and the Field Operations Unit in GIS software use revised fieldwork methodology. Discuss and determine fieldwork processes.
15h00 – 17h00	Determine practical fieldwork areas and prepare fieldwork maps
Sunday, 24 August	

10h00 – 16h00	Assessment report creation. Image correction and geotiff creation.
Monday, 25 August	
8h00 – 10h00	Creation and printing of field maps and documentation for the field exercise. Field exercise briefing
10h00 – 14h00	Field mapping exercise using digital imagery for urban area census mapping
14h00 – 16h30	Office updating exercises of field mapped EAs
18h00 – 20h00	Review and update of donor document
Tuesday, 26 August	
8h00 – 13h00	Field mappers go to field for more field mapping exercises. Consultant review and update donor document
13h00 – 14h00	Meeting with GSS consultants explaining GIS and imagery use
14h00 – 17h00	Office updating exercises of field mapped EAs Drawing up Census Mapping Assessment document
Wednesday, 27 August	
8h00 – 13h00	Completion of census mapping assessment document
13h00 – 14h00	Lunch
14h00 – 16h00	Further intermittent practical training of EA digitizing and GPS data integration techniques
16h00 – 17h00	Debriefing meeting with the Government Statistician, the local consultant and Ms. Quartey
Thursday, 28 August	
8h00 – 9h00	Creation of the selective bidding request document for satellite imagery
9h00 – 13h00	Wrap up technical training and report creation. Copying all the necessary spatial data for database compilation and projection correction for the November mission
13h00 – 15h00	Lunch
15h00	Leave for airport

13.5 Annexure 5: Census Mapping Assessment Document

To be provided as an accompanying, separate document

13.6 Annexure 6: Draft Donor Assistance document

To be provided as an accompanying, separate document

13.7 Annexure 7: Census Mapping Assessment presentation

To be provided as an accompanying, separate document

13.8 Annexure 8: Ghana Country Report

Introduction

The World Bank consultant to the GDDS Phase 2, GIS module, Mr. Francois Bezuidenhout arrived in Ghana on the 18th of August, 2008 and departed on the 28th. The objectives for his mission was to review our current census mapping progress, provide recommendations and findings to specifically our senior management and provide us with the necessary training in doing census mapping using the imagery and GIS.

All of these objectives were successfully reached during the mission.

The mission Terms of Reference detailed the specific deliverables for this mission. The following table is a breakdown of the mission deliverables with an indication of successful completion or not.

Specific deliverables according to the ToR

DELIVERABLE	COMPLETED
Assessed current activities	Yes. The current census mapping activities was assessed. A presentation was provided to the GSS senior management and the Census Mapping Assessment and Donor Assistance document was completed
Assessment report	Yes. The Census Mapping Assessment report is included in the Annexure
Imagery evaluation report	Yes. The newly acquired imagery was evaluated as well as additional requirements. A report on the imagery requirements is part of the Census Mapping Assessment document as was also explained in detail to our staff
Skilled and trained staff in the subject matter fields as specified in the ToR	Yes. Staff was trained in the use of imagery for census mapping in urban areas. The specific GIS operations regarding imagery use and heads up digitizing were also part of the training. Training also took place on GPS data integration and conversion and urban fieldwork methodology
Comprehensive supporting documentation and training materials	Yes. All the necessary training manuals were provided
Created and functional geodatabase at the GIS Unit	Yes. The digitizing warehouses have been developed and loaded. We are now able to proceed with urban mapping. However, the rest of the coastal imagery as well as some topographic and town plan data will be converted and integrated by the consultant before coming sown for the third mission.
Documented next steps and action plan to address any critical issues	Yes. This was explained during the presentation and in the Census Mapping Assessment document.

Timing

The time allocated to this mission was sufficient and allowed us to cover all the activities successfully.

General remarks

The mission was a success, specifically because the consultant was able to let the senior management realize that census mapping operations was not being implemented fast enough and that the GIS Unit is in dire need of funding and support. The presentation provided by the consultant enabled senior management to see the big picture and it sparked lively debate around how our specific problems can be solved.

The next mission will be critical for us since the consultant will be able to finalise the data re-projections and warehouse creation while also assessing our progress regarding the urban census mapping efforts. The training provided was invaluable and will allow us to continue in the mean time with the urban areas. The rural and urban methodology has now been clarified and has the approval of senior management.

Census Mapping Assessment Report

Prepared by:

Geospace International (Pty.) Ltd.

Francois Bezuidenhout

Prepared for:

The Ghana GSS

24 August 2008

Table of Contents

1. Introduction

The purpose of this report is to assess the current status and progress of census mapping within the GSS for the Population and Housing Census to take place in March, 2010.

The report will assess current status and progress, as well as explore reasons for any lack of progress while also highlighting pressing issues and actions. Furthermore, possible options, recommendations and actions will be provided which should assist the GSS in developing an action plan to overcome the challenges they are currently facing. The gist of this report emanates from the presentation provided to the GSS senior management during the weekly PHC meeting on the 21st of August and incorporates some of the resulting findings of that meeting.

2. Assessment of progress made regarding Census Mapping since the last mission

The previous GDDS mission took place during the last two weeks of January, 2008, approximately 7 months ago. Progress made by the GSS with regards to census mapping since the last mission is disappointing. The reasons for the lack of progress will be discussed later on, but first we will determine which positive progress has been made thus far. Following are the main actions that progress were made on.

- Fieldwork staff recruited, appointed and trained. The fieldwork staff training was completed in April 2008 and fieldwork commenced in June. Over 40 persons were recruited and trained and presently constitutes 10 fieldwork teams. These teams are currently in the field demarcation the northern regions district by district. Of the 168 districts, thus far 10 have been completed.
- UNFPA delivered some of the specified equipment, PC workstations and 20 Trimble Juno GPS units.
- There are plans in place to recruit and train fieldworkers in September for an additional 20 teams, increasing the total team compliment to 30.
- The current vehicle compliment is not sufficient but the vehicles used for the MIDA project will be released for census use as soon as the project ends in two months time. This will be a total of 15 vehicles.
- Digital imagery was acquired from the Survey Department covering the whole coastal area of Ghana up to 9km inland
- Most of the topographic and town plan vector information integration has been completed with two regions still outstanding.

The following list depicts actions which should have commenced by now, but was not implemented. Reasons will be discussed later on.

- Review and decide on an appropriate satellite imagery provision company. Appoint the relevant firm as soon as possible and draw up delivery schedule.
- Finalise the procurement for the additional hardware and software as specified in the GIS Situational Analysis and Infrastructure Assessment document.
- Finalise the Field Operations and GIS Unit staff training schedules and implement training.
- Acquire, process and integrate the first delivered satellite imagery into the GIS database
- Commence with census mapping activities for the areas covered with the coastal imagery. Ensure that at least 5 teams are seconded and trained for this process.

Although progress has been made in various areas, the GSS are currently running the risk of having too little time to complete census mapping activities. At the current pace and with the current resources and methodology, the GSS will not be able to complete accurate census mapping in time for the March 2010 deadline. What this lack of progress boils down to is that the GSS is facing a crisis regarding census mapping operations and ultimately, implementing the census itself.

2.1 Issues and Reasons

There are two interlinked issues which seem to be the route cause of all the delays and lack of implementation drive.

2.1.1 Lack of access to funding

Due to the fact that national elections are taking place later this year, as well as increased government expenditure regarding the oil bill introduced by the government, it seems as if government funding for census operations has taken a back seat. This is a typical scenario and not uncommon in some African countries that not enough funding is made available for census planning operations.

Consequently, sufficient funding was not available to implement many of the activities recommended by the consultant during the previous mission. Essential base map acquisition could not take place, the necessary census mapping database structures could not be developed and essential hardware and software could not be acquired.

Downstream logistics and procurement processes regarding the census operations as a whole as also being negatively affected.

Although the UNFPA have been engaged to provide certain equipment and consultancy services, it seems that donor agencies as a whole have not been sufficiently approached to assist with additional funding. The consequence is that there is no one to step in and fill the funding gap. This funding gap is currently causing delays in the whole census operations process and will ultimately lead to hasty and inaccurate census mapping and taking or to the census being postponed.

The irony is that the shorter the time available to implement census operations, the more it will cost. Financial resources needed to implement meaningful census mapping increases exponentially if to be implemented in a very short timeframe.

The Ghana GSS has unfortunately reached this point. Realistically, only 16 months are left to implement census mapping operations successfully. If the GSS wants to do it successfully, more financial and human resources would be needed that what was previously planned for. This also means revising the relevant donor documentation to reflect the increase in resources needed and engaging potential donors actively to secure funding.

It is critical that the relevant GSS senior management continuously engages on a face to face basis at the highest level with their counterparts at the Department of Finance so that they are constantly aware of the need for funding at the GSS. The GSS will also need to adjust their budget for the 2009 financial year so that sufficient provision is made for the census mapping and other downstream census operations.

Simply put, if sufficient funding is not acquired or pledged before the end of the year, it will be very difficult to adhere to the current deadline. Basically, it means that two scenarios will play itself out. In the first scenario, the census will still take place in March 2010, but census mapping would be a rush job which inevitably means inaccurate and shoddy work. This in turn will affect the accuracy of enumeration and analysis. The second scenario entails that the census is postponed to a later date to allow for the accurate completion of census mapping and more funding becoming available. Both of these scenarios will reflect negatively on the GSS and the Ghanaian government. They will be perceived by their peers as well as donors as not taking census operations seriously. Donors specifically will be less inclined to provide funding for future census operations. Moreover, downstream events such as national surveys and development planning will be negatively affected.

2.1.2 Lack of institutional drive

The consultant presented his view on the current census mapping status during the weekly Population and Housing Census planning meeting on the 21st of August. During the meeting it became clear that the GSS are facing certain coordination, communication and management issues which are causing as much delays in implementation as the lack of funding.

There seems to be confusion between line managers regarding responsibility and accountability protocols. Consequently, logistical processes which should be straight forward (such as the procurement of pencils) are being delayed since no one is taking coal face responsibility. Line managers seem to be reluctant to make any decision without the Government Statisticians explicit approval which is further causing delays.

The conducting of a census is a massive operation and every single operational decision cannot be ratified through one person. The GSS would need to review its current logistical, communication and procurement processes since they need to be streamlined and clarified.

In general, there seems to be a lack of implementation drive and initiative among senior and mid level managers and the Government Statistician conceded as much during the meeting. The meeting was honest and open and all concerned received and opportunity to air their views.

The conclusion was simple and was readily accepted. The conclusion was that the GSS management as a whole must take ownership of this census and must resolve the negative institutional processes hampering operational progress. They also realize that they themselves are the only ones who can resolve this issue since processes begins with people and only people can change processes.

Although the senior management has accepted their responsibility for this census and have indicated their willingness to take ownership, the proof of the pudding will be in the successful conclusion of the census.

It should be noted that all is not lost. There is still enough time to conduct successful census mapping operations before the deadline but action has to be taken now.

3. Implementation issues regarding Census Mapping

Cartographic work began in June 2008 with 10 field teams instead of the planned 30 teams due to inadequate funding. Moreover, the GSS initially planned to cover either the whole country or large parts of the country with digital imagery to augment the currently ineffective base maps, but this could also not take place due to a lack of funding. Currently therefore, they are forced to employ only the traditional means of census mapping which means extended fieldwork time, which is expensive. Moreover, it means that they do not have the current resources to complete census mapping on time.

An estimated number of 36,000 EAs are expected to be demarcated for the 2010 PHC. Unlike the previous censuses, the mapping exercise for the 2010 PHC will combine the manual and digital census mapping techniques. For the 2010 PHC, field updating of rural areas will be done using Global Positioning System (GPS) technology with the 2000 Census topographic EA maps. Field teams will therefore sweep the country district by district, locality by locality, demarcating EAs as they go along. Prominent landmarks and EA boundaries such as roads will be captured with the GPS units. This will ensure accuracy and ease in identifying the geographical location of localities. The problem is however that the GPS information is much more accurate than the underlying topographic base imagery, which will cause accuracy and integration issues when populated in the GIS database.

In the densely populated areas, the plan is to use digital aerial photography and satellite imagery to facilitate and speed up fieldwork to generate the EA maps. Maps of the EAs that

will be produced (Supervisory Areas and Base maps) will provide the basic framework for designing and implementing future surveys and censuses.

Some urgent short term implementation processes include:

- The establishment of an accurate cartographic base is essential to the creation of accurate census and survey cartography. The EAs for census 2000 was demarcated using outdated and inaccurate topographic maps and sketch mapping. The consequent digital EA base will therefore be only as accurate as the base it was demarcated from. Moreover, only the rural EAs and some urban EAs for Accra is currently in digital format. Although some town plan cadastral data is available digitally, sketch maps still have to be transposed onto the town plan maps. It is therefore preferable to obtain high resolution satellite imagery for at least the urban areas of Ghana to act as an accurate and current geographic base from which census mapping operations can be initiated and implemented.
- This imagery backdrop must not be seen as a once off census expenditure but an investment in a national asset which can serve the government as a whole, specifically with regard to infrastructure mapping and development projects regarding education, health and socio-economic upliftment. It will be possible for the government of Ghana to accurately determine the location and condition of every settlement within the country.
- The current equipment, specifically regarding map printing and production and data storage is hopelessly insufficient and needs to be addressed.
- The current staff compliment needs urgent detailed training in GIS software and census mapping techniques.
- The **GIS database and system** needs to be designed and implemented as soon as the equipment has been installed.

3.1 Funding and procurement

Currently, the whole Cartography unit is under funded. Taking into account all the hardware and software that needs to be acquired, as well as the training and skill transfer that needs to take place before any census mapping operations can commence, this is a critical issue. It must be mentioned here that the Cartography unit is hard pressed with time to complete census mapping successfully before the official census enumeration begins in March 2010. Time is therefore of the essence. Adequate funding must be mobilized as a matter of urgency in order to procure the necessary hardware, software and data and do the necessary training.

3.2 Procurement of Digital Imagery

Digital imagery is essential since it provides an up to date, current and accurate base on which census mapping can be done. First prize would be to cover the whole of the with high resolution satellite imagery which would provide the GSS with an accurate base not only for census mapping but also its annual surveys for many years to come. Moreover, it will be a national asset which can be used for infrastructural and development planning in health, education, environmental management, utilities, transport and many other application fields. In addition to providing a more accurate geographic base for census mapping, analysis and dissemination, imagery will also enable the GSS to minimize the time spent on fieldwork. Although fieldwork will always be necessary, the imagery allows field teams to operate more efficiently in the field with less errors leading to much more EAs completed per team per day. **Thus the use of imagery increases the field completion rate while also increasing accuracy.**

Fieldwork is the most expensive part of any census and therefore the cost saved in minimizing fieldwork can largely be used to fund the cost of digital imagery. The problem normally experienced is that where the cost of fieldwork accrues over time, satellite imagery is usually a lump sum cost to be paid in full when the order for imagery is made.

This causes many a financial manager to shy away from this seemingly large cost, without taking into account what two years of fieldwork will cost.

As noted, covering the whole country will be first prize, however, it might not be practically feasible. The option which is probably the **most practical and feasible** in the short term would be to cover all the urban areas with high resolution satellite imagery while doing the rural areas in the traditional manner using the outdated topographic map sheet information with the GPS technology.

3.3 Training

Appropriate and proper training for the Cartography unit staff is naturally important to the success of this project. Specialized GIS and database training would be needed at some point. The GSS is aware of this and have indicated that they will make the necessary arrangements for training to take place. Moreover, it would be difficult to do most of the training on-site at the GSS because of the lack of technical capacity and connectivity. Therefore, much of the specialized training will have to be done off site.

3.4 Implementation of the GIS

The whole census mapping process should be driven by an operational and sustainable GIS. The timely procurement of the necessary hardware and software, coupled with the training highlighted above will be paramount to the success of the census mapping effort. It is therefore essential that the GIS infrastructure and database be implemented before the end of November, 2008.

4. Current and Planned implementation actions

4.1 Current actions

As noted, currently there are 10 field teams covering the rural areas district by district, using a combination of topographic vector maps with 2000 Census EA information and GPS technology. Currently, one team completes approximately 75 EAs per month (a team comprises of a driver, supervisor and three field mappers). Of the expected 36000 EAs, the GSS expect about 60%of them to be rural, thus, an expected total of 21600 EAs. At present, approximately 2000 EAs have been completed in the field. Thus, a total of 19600 rural EAs will be left. Considering their current completion rate of 75 EAs per month per team (total 750 EAs per month), it will take the current team compliment 26 months just to complete the fieldwork. That does not take into account the time spent of downstream office editing, coding, GPS data integration, digitizing and map creation and printing, which easily adds another 6 months lag time.
Clearly, more resources are needed.

The GIS Unit has procured digital aerial photography from the Ghana Surveys Department which covers the entire coastline of Ghana for 9 km inland. They are planning to use this imagery to demarcate the covered areas, but as yet do not have the resources (specifically hardware, software and staff) to begin with the demarcation. They have been trained in the relevant methodology and are currently in doing field exercises. They will therefore be in a position to begin immediately when the relevant resources are in place, but hardware and software procurement is essential before they can begin.

4.2 Short Term Planned Actions

As noted the GSS is aware of the current shortcomings regarding resources and have planned the following within our limited budget frame.

During September an additional 120 fieldwork staff will be trained and put into the field during October. This translates to 20 teams. Of these 20 teams, 5 will be trained to focus specifically on the coastal areas using the currently available imagery. Since imagery is available, GPS units are not necessary because features are indicated directly on field photo maps which are then captured onto a GIS. The other 15 will focus on the rural areas, taking the total rural team compliment to 25.

They currently have 20 GPS Units of which 10 are in the field. The remaining 10 will be provided to the additional teams which mean they will have a shortage of 5 GPS units which will have to be procured.

Moreover, they will still need the satellite imagery covering the urban areas of Ghana to complete the rest of the urban EAs, as well as essential hardware and software before any GIS field mapping can commence.

4.3 How will these actions affect completion rates?

Let us assume the following:

- 25 rural fieldwork teams in place
- 5 urban fieldwork teams in place
- satellite imagery for all the selected urban areas in Ghana have been acquired
- the necessary GPS units acquired
- All ancillary logistics (vehicles, materials) are in place
- The necessary hardware and software have been procured
- The necessary GIS Unit staff compliment is in place

Of the total estimated 36000 2010 EAs, one can expect approximately 21600 to be rural and 14400 to be urban.

Regarding the rural areas, it is known that the current EA completion rate per team per month is 75. For the urban areas, it is known after the fieldwork exercises that one team of three mappers and one supervisor can complete on average 200 EAs per month.
For the rural, this means that the remaining 19600 EAs will be complete in approximately 11 months, all things being equal. If these teams are in place by November 2008, it means the fieldwork demarcation can be complete by October 2009, which will leave acceptable time for editing, GPS integration and map creation before January 2010.

It is however cutting it very close and does not allow for any contingencies. Experience has shown that census operations are filled with contingencies.

Considering the urban areas, a completion rate of 200 EAS per team per month will mean that a total of 15 months will be needed for the fieldwork to be completed. This figure needs to be decreased to at least 12 months. Again, it shows that more fieldwork teams will be needed.

5. The way forward

Considering the issues above, the way forward regarding resources and methodology becomes clear. It is apparent that the two pronged approach to the urban and rural areas will yield the best results taking into account the time the GSS have available as well as the possible funds.

5.1 Rural Methodology

- Assign 30 teams
- Estimated completion time of 10 months for fieldwork
- Additional 4 months for editing, coding, GPS data integration, digitizing, map creation and printing.
- Additional 10 GPS units to be procured
- Additional 20 vehicles needed
- Teams to sweep each locality district by district using the 2000 EA map information using topographic vector backdrop.
- Prominent EA boundary features and prominent landmarks to be captured with the GPS units
- GPS information to be downloaded on laptops of selected GIS unit staff which will visit field teams on an intermittent basis.
- GPS information will be integrated into the GIS Master Warehouse as it is received from the field
- The updated field maps will be sent to the editing unit at Head Office for QA
- It will then be sent to the coding section for final coding of EA numbers
- Afterwards it will be sent to the map production unit which will redraw the correct EA on a new hardcopy map
- On completion the EA maps will be sent to the GIS Unit who will digitize the EA boundary information onto the Master Warehouse and integrate it with the GPS information
- The final map creation and printing of the EA and SA maps will then commence.

5.2 Urban methodology

- Assign 10 field teams
- Estimated completion time of 8 months for fieldwork
- Assign 10 additional contract members to the GIS unit. They need to have GIS experience and their main task will be digitizing, GPS data integration, map creation and printing
- Acquire the satellite imagery for the selected urban areas – obtain quotations and select appropriate supplier.
- Obtain the necessary hardware and software
- Undergo the relevant training where necessary, specifically new recruits
- Field image maps will be produced on a locality by locality basis with the necessary additional descriptive information from the town plan maps (where available) and other additional information
- Of course, the GIS unit will need access to at least one high end A3 colour printer to produce these maps in the short term and another one in the long term to enable them to digitally create and print the EA and SA maps for enumeration
- Field teams will move into these areas with the image maps, EA annotation sheets and the 2000 Census sketch maps
- They will locate the relevant EAs and verify the sketch map information where relevant
- Where not relevant they will re-demarcate the EA
- Prominent landmarks as well as the EA boundaries will be depicted onto the image map and EA annotation sheet
- EAs will be assessed on estimated population size, boundary accuracy, type and other demarcation parameters
- The image map and annotation sheet will be sent directly to the GIS unit where it will be digitized and integrated into the Master Warehouse

6. Requirements and cost

6.1 Hardware requirements

The hardware requirements specified here pertains directly to the two methodologies described above. Costs provided are estimates only. Specifications are guidelines only.

Hardware Type	Quantity	Specifications	Cost (US$) (Tot. Quantity)
Personal Computers	5	120 Gig HDD, 1 Gig RAM, 17" LCD monitor, DVD ROM, 2 Ghz Intel Core Duo CPU	7,000.00
Laptops	2	120 Gig HDD, 1 Gig RAM, 17" screen, DVD ROM, 2 Ghz Intel Core Duo CPU	2,800.00
A3 colour printer	2	Up to 24 ppm A4 12 ppm A3 600x600 dpi with Imageret 4800 160Mb RAM 1x100 and 2x500 sheet std input Optional duplex unit Parallel and 10/100 NIC 200000 page/month duty cycle	18,000.00
GIS data and image server	1	Server Tower Proliant ML310 G4 DC Xeon 3050 2.13GHz – 1x2Mb SATA 512Mb (1x512Mb) 1P CDRom STD F DD Opt HP SATA Controller-R Memory 2 GB 667 MHz DDR2 PC-5300 Unbuffered advanced (1x2GB) DL320 G5ML110 G4ML310 G4 500 GB Pluggable SATA HDD x 5 SI HP Smart Array P400/512 Controller, LA Carepack	7,000.00
A0 colour plotter	1	HP 4000 Series A0 GIS plotter	10,000.00
20 Port hub	1		1,000.00
UPS units	10		3,500.00
Trimble Juno GPS Unit	10		8,500.00
Total			**57,800.00**

6.2 Software requirements

Software	Cost per License	# Of Licenses	Estimated cost in US$
Geomedia Professional 6.1	7,900.00	2	15,800.00
ArcGis 9.2 (Including Spatial Analyst and Image Analyst)	3,200.00	2	6,400.00
ArcPress	1,400.00	1	1,400.00
Adobe Acrobat Professional	1,000.00	1	1,000.00
Total			**24,600.00**

6.3 Imagery requirements

As noted before, acquiring imagery covering the whole of Ghana is very expensive. For example, SPOT 5 Colour imagery at 2.5 meter resolution covering the whole country (approximately 201 scenes) will cost around 3.8 million Euro.

However, the acquisition of high resolution satellite imagery such as Ikonos colour imagery at 1m resolution for the selected urban areas will cost in the vicinity of **$US 250,000.00**. This is a budgetary estimate only and in reality the cost should be less than that.

6.4 Human Resource requirements

Regarding the fieldwork requirements, an additional 30 teams must be put in place. This translates to a total of:

- 90 field mappers
- 30 drivers
- 30 supervisors

Regarding GIS Unit office requirements, additional 10 staff members are required with GIS experience on a contract basis for the duration of the census mapping exercise.

6.5 Other equipment

An additional 30 teams also means an additional 30 vehicles. Currently, 15 vehicles are used for the MIDA project which will be available and reassigned to the census project as soon as the MIDA project is complete in about a month's time. This leaves the total available vehicles at 25, which means another 15 vehicles will be needed. Although the GSS is confident about sourcing the additional vehicles from other government sources, there might be a need later on for donor assistance.

7. Responsibilities and Actions of GSS Senior Management

This pertains specifically to the Census Coordinator and the Divisional Head of Cartography, but also includes all other relevant senior managers and would need input from the Government Statistician.

- Organize and implement the planned Donor conference to inform donors and development partners about the current situation and the possibility of additional funding.
- Secure additional funding from development partners
- Secure additional funding from government, specifically the next financial year
- Approve the release of 5 PC workstations for the GIS Unit from the pool of workstations provided by the UNFPA

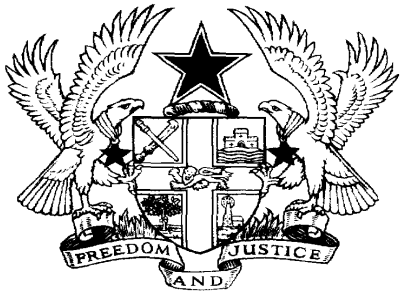
- Fix the current A0 plotter (if possible) and colour A3 printer at the GIS Unit. This will enable them to at least carry on with their urban fieldwork operations while a proper high end A3 colour printer is acquired
- Procure the necessary hardware and software needed for the GIS Unit to be effective and to drive the urban mapping process
- Obtain the funding to source and buy the satellite imagery for the selected urban areas.
- Approve the acquisition of a dedicated server for GIS at Head Office, as well as at least one A3 high volume colour printer during this financial year.
- Recruit, appoint and train the required compliment of fieldworkers as far as possible. Ensure that at least five fieldwork teams are seconded to the GIS Unit for urban mapping
- If possible, provision should be made for the appointment of at least 10 additional contract GIS staff before the end of this year which must assist the current compliment with digitizing and map creation of both rural and urban areas. This of course entail additional hardware and software
- Ensure that the necessary dedicated vehicles and motor cycles are provided to additional field teams, specifically those from the MIDA project
- Continued lobbying for sufficient census funding for the next two financial years at the Department of Finance must be a priority for GSS senior management. It might be a good idea to ask for assistance from departments such as Agriculture, Transport, Health, Local Government, Surveys and Education, who are very much dependent on an accurate geographic frame and population statistics for their own planning and operations. The assistance they can provide can be in the form of assisting the GSS management in lobbying for sufficient funds for census operations at the Department of Finance. Through their collective lobbying power, the Department of Finance can further be made aware the need and importance of accurate census planning and enumeration.
- Assure that the GSS budget for next year is sufficiently amended to accommodate the scenario depicted above.

8. Responsibilities and Actions of the GIS Unit

This pertains to the GIS Unit Head and staff

- Pressurize the relevant senior management into acquiring the necessary hardware (PC workstations, A3 printer, and server) and, most importantly, the high resolution satellite imagery for the selected urban areas.
- Pressurize the senior management to factor in the costs of the scenario sketched above into the line budget for the next two financial years.
- Continue with the traditional field operations in the rural areas
- Ensure that the rural demarcated maps are provided to the unit for digitizing by the map production and printing unit on a regular basis
- Continue with the integration and merging of the outstanding topographic map sheet and town plan data
- As soon as the small printer is fixed, schedule the fieldwork for Accra and the rest of the coastal areas and begin with the urban demarcation.
- Continue with the digitizing of demarcated rural and urban EAs as indicated using the relevant Census_2010_Master Warehouse.
- Continue with the downloading and conversion of GPS captured information and load it into the Census_2010_GPS_Warehouse.
- Ensure that the GIS staff obtains the necessary hands on experience in GIS operations and digitizing. Staff at Head office must be used optimally.
- Ensure that all the relevant software is procured and installed.
- Make regular follow-ups with senior management regarding any outstanding issues
- As each district is completed, ensure that the relevant district, SA and EA maps and created and printed and stored safely.

It should be evident that time constraints are such that the GSS has only one chance of implementing successful and accurate census mapping. Of key importance is that the senior management acts now and acts decisively. If the necessary funding is not secured by the end of this year, census mapping will not be completed in time or to international quality standards. It is the foundation of all census operations and failure to implement it correctly will ultimately lead to a failure in producing quality and reliable population statistics.



REPUBLIC OF GHANA

2010 Population and Housing Census

Funding Census Mapping and GIS Activities

Draft only

Ghana Statistical Service
P.O. Box GP 1098
Accra

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1. Executive Summary

Funding of Census Mapping activities of the 2010 Population and Housing Census of Ghana has reached a critical situation. Time is running out with realistically only 16 months left for census mapping operations, which forms the backbone of census enumeration and is a prerequisite for a successful census. The GSS is therefore appealing to development partners to come to its aid as a matter of urgency to complete the census mapping activities.

Due to the Government's current focus on the coming National Elections, insufficient funding has been provided for census mapping operations. Time constraints are such that funding for essential census mapping operations needs to be in place before October 2008 for the GSS to realistically complete in time and within acceptable accuracy parameters. Any further delays in census mapping operations might lead to the census enumeration being postponed. This is not an option that the GSS want to consider since it will reflect badly on the organization as well as the country.

The GSS is therefore committed to conduct all the census processes in a timely and accurate fashion and has taken ownership of the process. However, urgent funding is needed for us to continue not only our current operations but also to expand current operations further.

Accurate and effective census mapping is one of the pre-requisites for accurate census taking. Accurate census mapping in turn depends on the methodology implemented as well as the accuracy of current base maps. The GSS is currently dependant on out of date topographic map sheets (some 30 years old), 2000 Census sketch maps and town plan maps for its base map purposes. Moreover, the GSS wants to increase the capacity of its current GIS Unit in order to allow for digital mapping and spatial analysis and dissemination which will better satisfy current user needs. It has therefore become critical to obtain high resolution satellite imagery for the whole or at least parts of Ghana to act as an accurate and current geographic base from which census mapping operations can be initiated and implemented, while also increasing the capacity of the GIS Unit to deal with the increasing technological demands of users and development agencies.

Expenditure on imagery backdrop must not be seen as a once off census expenditure but an investment in a national asset which can serve the government as a whole, specifically with regard to infrastructure mapping and development projects regarding education, health and socio-economic upliftment.

On a whole, our current field team compliment must be increased from 10 to 40 teams for us to complete the census mapping operations in time. Moreover, we would need additional expenditure on hardware, software and human resources to proper equip our current GIS Unit with the necessary tools to fulfill their role effectively in the forthcoming census operations.

The purpose of this document is to focus on the cost of specific hardware, software, human resources, imagery and other equipment costs which would be necessary for us to complete the census mapping in time. Specific requirements and costs are related in section 8.

2. Background

Population is at the centre of all planning activities. There cannot be any meaningful developmental activity which does not first consider the characteristics of the population for whom the activity is targeted at. The size of the population, its distribution over space, growth and change over time, in addition to socio-economic characteristics are all important in development planning. The Kilimanjaro Programme of Action on Population adopted by African countries in 1984 stressed that population should be a key factor in the formulation of development strategies and plans and pointed out that population and development are related**.**

Substantial amounts of population data have been produced by the Ghana Statistical Service (GSS) over the years through national sample surveys, censuses, and reports from administrative sources. After Ghana's independence in 1957, there was the need for up to date demographic and socio-economic data on the country for effective planning. This need was met by the results of the 1960 Population Census, the first post independence and modern census in Ghana. Subsequently, censuses were conducted in 1970, 1984, and in 2000. It is worth mentioning that, Ghana has not been able to keep to the decennial census-taking programme. Apart from the 1970 Census which was taken 10 years after the 1960 Census, other post independence censuses did not meet this ten-year periodicity requirement, thus creating data gaps. To avoid the creation of further data gaps in the country, there is the need for Ghana to organize its census in 2010.

3. Justification for the Census

A population census is the total process of collecting, compiling, evaluating, analysing, publishing and disseminating demographic, economic, and social data and information pertaining to all persons in a country at a specific time. A housing census is the process of collecting, compiling, evaluating, analyzing, publishing and disseminating statistical data pertaining to living quarters in a country at a specific time. As in the case of the 2000 Census, the 2010 Census will cover both population and housing.

The 1969 Population Policy of Ghana, which was revised in 1994, provides the framework within which population activities are to be organised. One of the principal elements of the Policy is the establishment of "specific and quantitative population goals on the basis of reliable demographic data and the determination of demographic trends"

Since the last census in 2000, the country has undergone changes in population distribution and settlement patterns in many areas due to the creation of additional districts, migration induced by uneven economic development in the districts and regions. The changes in population size, structure and distribution have affected the sizes of many of the 2000 Census Enumeration Areas (EA). The Geographic frame of the 2000 PHC has become outdated and needs a thorough revision to make it reliable and effective**,** detailed with well defined boundaries and usable in future statistical analysis and dissemination including the 2010 PHC.

The 2010 PHC in Ghana is conceived as the most plausible means to obtain current information on the population and housing characteristics of the country. Data collected from sample surveys only provide estimates of a sample of the population and are subject to sampling errors. The population census, which entails enumeration of the total population, will provide an overall picture of the demographic and socio-economic situation of the whole country.

Specifically, the 2010 Census;

- Will take place in March 2010 to keep in line with the decennial census-taking programme. The conduct of the 2010 PHC also stems from the overarching importance of the census for the fulfillment of international requirements for data availability and international comparability for measuring the progress of countries.

- Will provide updated data on demographic and socio-economic characteristics at national, regional, district (including data for the newly created districts), constituency and locality levels.
- Will provide results that will be a critical reference to ensure equity in the distribution of resources, government services and representation at both national, regional and district levels: distributing and allocating government funds among various regions and districts for education, health services, measuring the impact of industrial development, to mention but a few.
  Will also afford the country with the opportunity of revising its electoral areas and constituencies
- Will provide an updated sampling frame (comprehensive list of all enumeration areas in Ghana with relevant characteristics) for the conduct of future statistical enquiries.
- Will provide data that can be used to track the progress of the poverty reduction programmes and other core targets of the economy that will facilitate the tracking of the progress towards the achievement of the MDGs. It will also provide data for measuring the success or otherwise of national development programmes such as the National Identification System and the National Health Insurance Scheme (NHIS).
- Combined with results from such on-going national sample surveys such as the Ghana Living Standards Survey (GLSS), the Core Welfare Indicators Questionnaire Survey (CWIQ), and the Ghana Demographic and Health Survey (GDHS) series, will constitute an invaluable data base for policy formulation, monitoring and evaluation.
- Since 2000, the Ghana Statistical Service has introduced a number of user-friendly data dissemination tools such as GhanaInfo and IMIS (Integrated Management Information System) databases. These have generated much interest among policy makers, educational institutions, development partners, UN agencies, civil society organisations, researchers, the media and the general public. In order to keep faith with all these stakeholders and satisfy their data needs, regular updates of the data which are largely from the census, are imperative and the GIS Unit is particular will need the capacity and skills to fulfill its role in this process.

4. Census Mapping Operations

4.1 Introduction

The Cartography unit of the National Census Secretariat has been given the responsibility of the planning and implementation of the Census Mapping phase. Census mapping involves the accurate updating of the current administrative and geographic frame of the country and the systematic demarcation of this frame into small units called Enumeration Areas (EAs) for enumeration, spatial analysis and dissemination purposes.

The role of spatial information in a census is to provide the cartographic basis for enumeration and the master sampling frame for surveys and the platform for spatial census data products such as census atlases and thematic map sets such as poverty maps. Moreover, the digital spatial database is an excellent tool which facilitates spatial analysis of census indicators, meaning that not only the attribute but the spatial component are taken into account during analysis. Analyzing the spatial component with the attribute component allows us to make correlations between different datasets and indicators which might have been previously hidden. As mentioned, accurate and effective demarcation is one of the pre-requisites for accurate census taking.

The aim of census mapping is to provide the cartographic basis to be used during the actual process of counting. The census cartographic unit therefore needs to provide the census enumeration team with a set of unique maps covering the entire country that accurately defines the boundaries within which each interviewer (enumerator) has to work during the enumeration phase of the census.

In order to do this the census cartographic unit needs to have access to current base maps of sufficient levels of scale and detail. In Ghana, as in most African countries the required maps are either very old (often 30 years and older) or in some cases do not exist at all.

In recent times the need for quality and relevant statistics for developmental planning purposes is bigger than ever. The GSS therefore has to adjust in order to respond to the spatial data needs of their users by using Geographical Information Systems (GIS) more effectively and increasing its capacity.

This would be a step in the right direction and more emphasis should be placed on the use of GIS and geographical information technology (GIT) in pre-census activities. In doing so the platform for small-area (spatial) census data products would be created as a direct deliverable of the methodology.

4.2 Cartographic Work

Cartographic work is the largest pre-enumeration operation and its success is vital for conducting a good quality census. In order to minimize any census coverage errors, the census enumeration areas (EAs) delineated for the census fieldwork should have well-defined and non-overlapping boundaries and should all together cover the total land area of Ghana. Cartographic work began in June 2008 with 10 field teams instead of the planned 30 teams due to inadequate funding. Moreover, the GSS initially planned to cover either the whole country or large parts of the country with digital imagery to augment the currently ineffective base maps, but this could also not take place due to a lack of funding. Currently therefore, we are forced to employ only the traditional means of census mapping which means extended fieldwork time, which is expensive. Moreover, it means that we do not have the current resources to complete our census mapping on time.

The use of imagery will therefore not only speed up our fieldwork operations and allow us to finish in time but it will also provide the GSS with a more accurate base to create enumeration maps from and conduct spatial analysis and dissemination from.

The scheme of the cartographic work is based on the Administrative/Local Government structure of the country. Currently, the country is divided into 10 administrative regions and 168 districts. The 1992 Constitution makes the district the basic unit of administration in the country. This makes it imperative for the GSS to publish the results of any census and statistical enquiries on the basis of this constitutional requirement.

An estimated number of 36,000 EAs are expected to be demarcated for the 2010 PHC. Unlike the previous censuses, the mapping exercise for the 2010 PHC will combine the manual and digital census mapping techniques. For the 2010 PHC, field updating of rural areas will be done using Global Positioning System (GPS) technology with the 2000 Census topographic EA maps. Field teams will therefore sweep the country district by district, locality by locality, demarcating EAs as they go along. Prominent landmarks and EA boundaries such as roads will be captured with the GPS units. This will ensure accuracy and ease in identifying the geographical location of localities. The problem is however that the GPS information is much more accurate than the underlying topographic base imagery, which will cause accuracy and integration issues when populated in the GIS database.

In the densely populated areas, the plan is to use digital aerial photography and satellite imagery to facilitate and speed up fieldwork to generate the EA maps. Maps of the EAs that will be produced (Supervisory Areas and Base maps) will provide the basic framework for designing and implementing future surveys and censuses.

Some urgent short term implementation processes include:

- The establishment of an accurate cartographic base is essential to the creation of accurate census and survey cartography. The EAs for census 2000 was demarcated using outdated and inaccurate topographic maps and sketch mapping. The consequent digital EA base will therefore be only as accurate as the base it was demarcated from. Moreover, only the rural EAs and some urban EAs for Accra is currently in digital format. Although some town plan cadastral data is available digitally, sketch maps still have to be transposed onto the town plan maps. It is therefore preferable to obtain high resolution satellite imagery for at least the urban areas of Ghana to act as an accurate and current geographic base from which census mapping operations can be initiated and implemented.
- This imagery backdrop must not be seen as a once off census expenditure but an investment in a national asset which can serve the government as a whole, specifically with regard to infrastructure mapping and development projects regarding education, health and socio-economic upliftment. It will be possible for the government of Ghana to accurately determine the location and condition of every settlement within the country.
- The current equipment, specifically regarding map printing and production and data storage is hopelessly insufficient and needs to be addressed.
- The current staff compliment needs urgent detailed training in GIS software and census mapping techniques.
- The **GIS database and system** needs to be designed and implemented as soon as the equipment has been installed.

5. What is the need?

Due to recent advances in technology and as a result of the processing power of computers and software packages increasing by the day, advances in Geographical Information Technology (GIT) has leapt over the last few years. The integration and utilization of GIS, GPS and remote sensing are also becoming easier and more cost effective. There can be no doubt that the right tools exist and it has never been easier to utilize these tools in geospatial applications. It is argued that, if implemented as part of a population and housing census project, the technology is now within the financial reach and technical capabilities of most statistical agencies in Africa.

The GSS needs technical and financial assistance regarding the implementation of modern census methodology, the use of digital imagery for census mapping as well as the successful implementation and use of Geographic Information Systems (GIS) to drive the whole process, including all the ancillary issues that are implicated, such as staffing, equipment, software and infrastructure.

Moreover technical assistance is needed regarding the sustainability and maintenance of the GIS, specifically with regard to training and skills transfer.

The use of digital imagery and GIS techniques in the census mapping process enables an organization to accurately demarcate the whole country within a prescribed and correct geographic frame. If digital census mapping is applied correctly and optimally it is guaranteed to provide better quality results when compared to conventional mapping. The normal errors associated with census mapping such as incomplete coverage or double coverage of the same area is to a large extent eradicated.

There are certain critical issues which need to be addressed for the Census Mapping methodology and GIS to be implemented successfully. These are:

5.1 Funding and procurement

Currently, the whole Cartography unit is under funded. Taking into account all the hardware and software that needs to be acquired, as well as the training and skill transfer that needs to take place before any census mapping operations can commence, this is a critical issue. It must be mentioned here that the Cartography unit is hard pressed with time to complete census mapping

successfully before the official census enumeration begins in March 2010. Time is therefore of the essence. Adequate funding must be mobilized as a matter of urgency in order to procure the necessary hardware, software and data and do the necessary training.

5.2 Procurement of Digital Imagery

Digital imagery is essential since it provides an up to date, current and accurate base on which census mapping can be done. First prize would be to cover the whole of the with high resolution satellite imagery which would provide the GSS with an accurate base not only for census mapping but also its annual surveys for many years to come. Moreover, it will be a national asset which can be used for infrastructural and development planning in health, education, environmental management, utilities, transport and many other application fields. In addition to providing a more accurate geographic base for census mapping, analysis and dissemination, imagery will also enable the GSS to minimize the time spent on fieldwork. Although fieldwork will always be necessary, the imagery allows field teams to operate more efficiently in the field with less errors leading to much more EAs completed per team per day. Thus the use of imagery increases the field completion rate while also increasing accuracy. Documented cases, such as for the Lesotho 2006 Census, indicated that fieldwork took place 4 times faster with imagery than without it.

Fieldwork is the most expensive part of any census and therefore the cost saved in minimizing fieldwork can largely be used to fund the cost of digital imagery. The problem normally experienced is that where the cost of fieldwork accrues over time, satellite imagery is usually a lump sum cost to be paid in full when the order for imagery is made.

This causes many a financial manager to shy away from this seemingly large cost, without taking into account what two years of fieldwork will cost.

As noted, covering the whole country will be first prize, however, it might not be practically feasible. The option which is probably the most practical and feasible in the short term would be to cover all the urban areas with high resolution satellite imagery while doing the rural areas in the traditional manner using the outdated topographic map sheet information with the GPS technology.

5.3 Training

Appropriate and proper training for the Cartography unit staff is naturally important to the success of this project. Specialized GIS and database training would be needed at some point. The GSS is aware of this and have indicated that they will make the necessary arrangements for training to take place. Moreover, it would be difficult to do most of the training on-site at the GSS because of the lack of technical capacity and connectivity. Therefore, much of the specialized training will have to be done off site.

5.4 Implementation of the GIS

The whole census mapping process will be driven by an operational and sustainable GIS. The timely procurement of the necessary hardware and software, coupled with the training highlighted above will be paramount to the success of the census mapping effort. It is therefore essential that the GIS infrastructure and database be implemented before the end of November, 2008.

6. What is the plan?

6.1 Current actions

As noted, currently there are 10 field teams covering the rural areas district by district, using a combination of topographic vector maps with 2000 Census EA information and GPS technology. Currently, one team completes approximately 75 EAs per month (a team comprises of a driver, supervisor and three field mappers). Of the expected 36000 EAs, we

expect about 60%of them to be rural, thus, an expected total of 21600 EAs. At present, approximately 2000 EAs have been completed in the field. Thus, we have a total of 19600 rural EAs left. Considering our current completion rate of 75 EAs per month per team (total 750 EAs per month), it will take the current team compliment 26 months just to complete the fieldwork. That does not take into account the time spent of downstream office editing, coding, GPS data integration, digitizing and map creation and printing, which easily adds another 6 months lag time.

Clearly, more resources are needed.

The GIS Unit has procured digital aerial photography from the Ghana Surveys Department which covers the entire coastline of Ghana for 9 km inland. They are planning to use this imagery to demarcate the covered areas, but as yet do not have the resources (specifically hardware, software and staff) to begin with the demarcation. They have been trained in the relevant methodology and are currently in the field doing field exercises. They will therefore be in a position to begin immediately when the relevant resources are in place.

6.2 Short Term Planned Actions

We are aware of the current shortcomings regarding resources and have planned the following within our limited budget frame.

During September an addition 120 fieldwork staff will be trained and put into the field during October. This translates to 20 teams. Of these 20 teams, 5 will be trained to focus specifically on the coastal areas using the currently available imagery. Since imagery is available, GPS units are not necessary because features are indicated directly on field photo maps which are then captured onto a GIS. The other 15 will focus on the rural areas, taking the total rural team compliment to 25.

We currently have 20 GPS Units of which 10 are in the field. The remaining 10 will be provided to the additional teams which means we will have a shortage of 5 GPS units which will have to be procured.

Moreover, we will still need the satellite imagery covering the urban areas of Ghana to complete the rest of the urban EAs.

6.3 How will these actions affect completion rates?

Let us assume the following:

- We have 25 rural fieldwork teams in place
- We have 5 urban fieldwork teams in place
- We have acquired the satellite imagery for all the selected urban areas in Ghana
- We have acquired the necessary GPS units
- All ancillary logistics (vehicles, materials) are in place

Of the total estimated 36000 2010 EAs, we expect approximately 21600 to be rural and 14400 to be urban.

Regarding the rural areas, we know that the current EA completion rate per team per month is 75. For the urban areas, we know after the fieldwork exercises that one team of three mappers and one supervisor can complete on average 200 EAs per month.

For the rural, this means that the remaining 19600 EAs will be complete in approximately 11 months, all things being equal. If these teams are in place by November 2008, it means the fieldwork demarcation can be complete by October 2009, which will leave acceptable time for editing, GPS integration and map creation before January 2010.

It is however cutting it very close and does not allow for any contingencies. Experience has shown that census operations are full of contingencies.

Considering the urban areas, a completion rate of 200 EAS per team per month will mean that a total of 15 months will be needed for the fieldwork to be completed. This figure needs to be decreased to at least 12 months. Again, it shows that we will need more fieldwork teams.

7. The way forward

Considering the issues above, the way forward regarding resources and methodology becomes clear. It is apparent that the two pronged approach to the urban and rural areas will yield the best results taking into account the time we have available as well as the possible funds.

7.1 Rural Methodology

- Assign 30 teams
- Estimated completing time of 10 months for fieldwork
- Additional 4 months for editing, coding, GPS data integration, digitizing, map creation and printing.
- Additional 10 GPS units to be procured
- Additional 20 vehicles needed
- Teams to sweep each locality district by disctrict using the 2000 EA map information using topographic vector backdrop.
- Prominent EA boundary features and prominent landmarks to be captured with the GPS units
- GPS information to be downloaded on laptops of selected GIS unit staff which will visit field teams on an intermittent basis.
- GPS information will be integrated into the GIS Master Warehouse as it is received from the field
- The updated field maps will be sent to the editing unit at Head Office for QA
- It will then be sent to the coding section for final coding of EA numbers
- Afterwards it will be sent to the map production unit which will redraw the correct EA on a new hardcopy map
- On completion the EA maps will be sent to the GIS Unit who will digitize the EA boundary information onto the Master Warehouse and integrate it with the GPS information
- The final map creation and printing of the EA and SA maps will then commence.

7.2 Urban methodology

- Assign 10 field teams
- Estimated completion time of 8 months for fieldwork
- Assign 10 additional contract members to the GIS unit. They need to have GIS experience and their main task will be digitizing, GPS data integration, map creation and printing
- Acquire the satellite imagery for the selected urban areas – obtain quotations and select appropriate supplier.
- Obtain the necessary hardware and software
- Undergo the relevant training where necessary, specifically new recruits
- Field image maps will be produced on a locality by locality basis with the necessary additional descriptive information from the town plan maps (where available) and other additional information
- Of course, the GIS unit will need access to at least one high end A3 colour printer to produce these maps in the short term and another one in the long term to enable them to digitally create and print the EA and SA maps for enumeration
- Field teams will move into these areas with the image maps, EA annotation sheets and the 2000 Census sketch maps
- They will locate the relevant EAs and verify the sketch map information where relevant
- Where not relevant they will re-demarcate the EA
- Prominent landmarks as well as the EA boubndaries will be depicted onto the image map and EA annotation sheet

- The image map and annotation sheet will be sent directly to the GIS unit where it will be digitized and integrated into the Master Warehouse

8. Requirements and cost

8.1 Hardware requirements

The hardware requirements specified here pertains directly to the two methodologies described above. Costs provided are estimates only. Specifications are guidelines only.

Hardware Type	**Quantity**	**Specifications**	**Cost (US$) (Tot. Quantity)**
Personal Computers	5	120 Gig HDD, 1 Gig RAM, 17" LCD monitor, DVD ROM, 2 Ghz Intel Core Duo CPU	7,000.00
Laptops	2	120 Gig HDD, 1 Gig RAM, 17" screen, DVD ROM, 2 Ghz Intel Core Duo CPU	2,800.00
A3 colour printer	2	Up to 24 ppm A4 12 ppm A3 600x600 dpi with Imageret 4800 160Mb RAM 1x100 and 2x500 sheet std input Optional duplex unit Parallel and 10/100 NIC 200000 page/month duty cycle	18,000.00
GIS data and image server	1	Server Tower Proliant ML310 G4 DC Xeon 3050 2.13GHz – 1x2Mb SATA 512Mb (1x512Mb) 1P CDRom STD F DD Opt HP SATA Controller-R Memory 2 GB 667 MHz DDR2 PC-5300 Unbuffered advanced (1x2GB) DL320 G5ML110 G4ML310 G4 500 GB Pluggable SATA HDD x 5 SI HP Smart Array P400/512 Controller, LA Carepack	7,000.00
A0 colour plotter	1	HP 4000 Series A0 GIS plotter	10,000.00
20 Port hub	1		1,000.00
UPS units	10		3,500.00
Trimble Juno GPS Unit	10		8,500.00
Total			**57,800.00**

8.2 Software requirements

Software	Cost per License	# Of Licenses	Estimated cost in US$
Geomedia Professional 6.1	7,900.00	2	15,800.00
ArcGis 9.2 (Including Spatial Analyst and Image Analyst)	3,200.00	2	6,400.00
ArcPress	1,400.00	1	1,400.00
Adobe Acrobat Professional	1,000.00	1	1,000.00
Total			**24,600.00**

8.3 Imagery requirements

As noted before, acquiring imagery covering the whole of Ghana is very expensive. For example, SPOT 5 Colour imagery at 2.5 meter resolution covering the whole country (approximately 201 scenes) will cost around 3.8 million Euro.

However, the acquisition of high resolution satellite imagery such as Ikonos colour imagery at 1m resolution for the selected urban areas will cost in the vicinity of **$US 250,000.00**. This is a budgetary estimate only and in reality the cost should be less than that. Official quotes obtained put the cost around the $210k mark.

8.4 Human Resource requirements

Regarding the fieldwork requirements, an additional 30 teams must be put in place. This translates to a total of:

- 90 field mappers
- 30 drivers
- 30 supervisors

Regarding GIS Unit office requirements, additional 10 staff members are required with GIS experience on a contract basis for the duration of the census mapping exercise.

8.5 Other equipment

An additional 30 teams also means an additional 30 vehicles. Currently, 15 vehicles are used for the MIDA project which will be available and reassigned to the census project as soon as the MIDA project is complete in about a month's time. This leaves the total available vehicles at 25, which means another 15 vehicles will be needed. Although the GSS is confident about sourcing the additional vehicles from other government sources, there might be a need later on for donor assistance.

Current Census Cartography Assessment

Presentation to the Ghana GSS

21 August 2008

Crisis in Census Mapping

- 7 Months has passed since 1st mission
- Most recommendations not implemented due to lack of access to sufficient funding/implementation drive/institutional support/management and communication
- Little imagery acquired, but not used; data not integrated, base maps outdated; fieldwork behind schedule
- Maximum 16 months left for census mapping operations

All things being equal, insufficient time left for successful census mapping implementation!

Unless = Extreme and Immediate Intervention

The Problem

Due to lack of access to funds and implementation drive – traditional census methodology

IRONY: Traditional Census Methodology + Less Implementation Time = Exponential Increase in Financial, Equipment and Human Resources

Census 2000 = 26760 EAs Assume 20% increase = 32112 EAs

Currently: 10 teams in place of 5 persons per team – 3 mappers, 1 supervisor, 1driver

One team completes 75 EAs per month, thus, 10 teams completes 750 EAs per month = 43 months to complete fieldwork = 3.6 years = end of 2011 completion.

Even if field teams increased to 20, 21 months needed. I we assume additional teams to be in place by November, it means completion date by July 2010.

Hovever, this is fieldwork completion only. Time lag must be allowed for logistics, coding, map creation and production – manual process – minimum additional 6 months before all EA and SA maps are ready and distributed – January 2011

Funding Issues

Very little funding currently available from government due to coming elections and oil bill.

Donors must be engaged as a matter of urgency

Result: Insufficient funding for census mapping activities
Result: Census Mapping behind schedule

Consequence: Incomplete, inaccurate Census Cartography, leading to inaccurate enumeration, analysis and dissemination – Worst case scenario – Postpone Census

Consequence: Downstream implications

- Ineffective GIS Unit and lack of capacity building;
- Lack of technological advancement
- Inaccurate statistics and dissemination frame;
- Inaccurate Geographic Frame for Surveys

Implication: Due to unsuccessful Census operations, GSS seen as ineffective by peers and donors

The Reasons

During previous mission, the following challenges were mentioned:

- Inadequate integrated and properly designed data warehouse and database
- Inadequate awareness within the organization as a whole regarding the potential and use of GIS in statistical agencies
- Lack of institutional support regarding the on going maintenance and sustainability of GIS
- Inadequate geographic base data
- Inadequate equipment
- Although a semi-sufficient quota staff is in place, more skills development and training is needed for them to implement the holistic process and potential of GIS
- Inadequate funding and operational assistance to make the difference

The Reasons

Critical Actions which were not implemented:

Secure adequate donor funding

Secure adequate government funding, or determine plan or schedule

Satellite imagery necessary for urban areas not acquired

Finalise the procurement for the additional hardware and software as specified in the GIS Situational Analysis and Infrastructure Assessment document – Specifically software and A3 printers.

The GIS Unit must be adequately staffed and trained. The few weeks spent on these technical assistance missions is not enough. A dedicated team must be here for at least a month to attend to issues such as:

- Comprehensive hands on training
- Data integration and database population
- Process monitoring and trouble shpooting
- Hardware and system setup, testing
- Map creation and printing workflow

The Reasons

Initial Risks Identified which now became reality

Inadequate Implementation Drive – Failure to implement basic mission recommendations within reasonable timeframe

Inadequate Governmental Support – Lack of timeous and adequate funding

Inappropriate Implementation Partner – Not relevant

Inadequate Sustainability – Proper Institutional and ongoing Financial Support

Failure to reach short term goals – Currently, most important short term goals not reached.

Possible Solution

Dual Approach

Reality: Not enough funding to buy imagery covering the whole country, even though imagery is less expensive than fieldwork.

Reality: Not enough time available with current approach

Option: Dual approach. Traditional approach for rural, modern approach for urban

Basic premise: Double the number of field teams which will focus solely in the completion of the rural areas. The current split of rural urban EAS is 60/40.

Thus: 19267 estimated rural EAS. 20 teams will take 13 months to complete these EAs whilst adding at least three months coding and map production time = 16 months

Possible Solution

Option: Dual approach. Traditional approach for rural, modern approach for urban

Basic premise: For the urban EAS, cover all of them with high resolution satellite imagery as soon as possible. Cost = Appx $250000. Use in combination with current coastal imagery acquired.

Add additional 5 teams (3 mappers, one supervisor, one driver). Total estimated number of 12845 urban EAS. One team can complete 9 EAs per day (3 per person), thus 225 EAS per month thus 1125 EAs per month for all five teams.

This translates to a completion time of 11 months, including map creation and printing lag time of two months = 13 months.

BUT
Implementation of this approach would assume necessary funding in place and accessible.
And – necessary hardware and software is in place.

CURRENTLY, THIS IS NOT THE CASE

Logistics Issues

Moreover – implementing this approach assumes necessary logistics is in place.

Equipment:
Vehicles
GPS Units – Additional units must be obtained if field teams are to be increased. Will funding be available? How long does the Tender and acquisition process take?
A 3 Printers
Workstations
SOFTWARE!!!!!!!!!!!!!

Management structures: Increasing field teams means augmenting management structures. More managers, more supervisors, better Monitoring and Evaluation tools

Conclusion

Main obstacle: Lack of funding and implementation drive

NO TIME LEFT – Immediate and drastic action needed, or census mapping and enumeration will be a failure.

Department of Finance and Donors must be approached as a matter of urgency to secure special funding OR future funding schedule must be agreed upon with Finance so that proper planning can be done.

Necessary additional equipment, software and base imagery must be acquired before November.

Current Mission Progress

Pathfinder office training provided

New data dictionary designed and created

Current census process flow and status reviewed

Currently struggling with data integration and warehouse compilation issues – hope to resolve that today. Will begin with practical methodological training on Friday. Fieldwork training Monday and Tuesday. Software training Wednesday and Thursday.

Mission report and consolidated data

Will all mean nothing if dedicated budget not obtained.

Thank You