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United Nations Expert Group Meeting on
Contemporary Practices in Census Mapping and
Use of Geographical Information Systems
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Report of the Expert Group Meeting on Contemporary Practices in Census Mapping and Use of Geographical Information Systems*

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I. Introduction

A. Background and objective of the meeting

1. The United Nations Expert Group Meeting on Contemporary Practices in Census Mapping and Use of Geographical Information Systems was convened in New York, 29 May - 1 June 2007. The meeting was organized by the Demographic Statistics Section of the United Nations Statistics Division (UNSD), Department of Economic and Social Affairs (DESA), in response to the call of various international fora for improved census mapping with use of geospatial technologies. (See Annex 1 for information note on the meeting.)

2. The main objectives of the meeting were to (i) review the conceptual framework and different approaches to census mapping and the capabilities offered by advanced geospatial technologies (Geographical Information Systems, Global Positioning Systems, Remote Sensing, Internet Mapping, etc.) to support census mapping operations; (ii) review geo-coding concepts and approaches with respect to data collection; (iii) assess the use of Global Positioning System and other geospatial technologies for digital delineation of enumeration areas and data collection; (iv) review the development of geographic databases, spatial analysis and data dissemination; and (v) identify organizational and institutional issues associated with census cartography.

3. The meeting brought together experts on census geography —representatives of national statistical offices, national mapping offices, academic/research institutions, GIS private companies as well as international and regional organizations. Participants included experts from 22 countries— Australia , Brazil, Canada, China, India, Indonesia, Jordan, Kenya, Latvia, Mexico, Morocco, Namibia, Oman, the Philippines, Portugal, Russian Federation, Sierra Leone, South Africa, Trinidad and Tobago, Turkey, Ukraine, and the United States of America—two of whom were from national academic/research institutions—Florida State University and George Washington University (USA). It also included experts from international and regional organizations—the United Nations Population Fund (UNFPA). (See Annex 2 for the list of participants.)

B. Opening Session

4. The meeting was opened by Mr. Jeremiah Banda, Chief of the Demographic and Social Statistics Branch, who read a statement on behalf of the Director of the United Nations Statistics Division, Dr. Paul Cheung. In his statement, the Director highlighted the importance of census mapping as a critical aspect of census activities and informed the participants that the *Principles and Recommendations for Population and Housing Censuses, Rev 2*. include a detailed section on census mapping and use of GIS. It was pointed out, however, that setting up and maintaining a good geographic information system could be both time and resource consuming and requires a lot of commitment within a country.

5. It was mentioned that the meeting provided an opportunity for sharing of national experiences as well as for reviewing and assessing the different methods for the

integration of geospatial technologies with the census mapping operations. In the course of the meeting, participants were expected to identify constraints to the implementation of a digital census mapping program and suggest appropriate solutions to overcome them. Furthermore, participants were requested to come up with concrete recommendations that would form a basis for future guidelines on best practices in the area of census mapping.

6. Mr. Banda reiterated the objectives of the meeting, welcomed the participants and invited the delegates to introduce themselves.

C. Organization of the meeting

7. As laid out in the Organization of work (Annex 3), the meeting was structured along the following main topics: (i) GIS-based census mapping approaches: some country experiences; (ii) Geocoding concepts and definitions, and approaches to data collection; (iii) Use of GPS and geospatial technologies for data collection, and digital delineation of enumeration areas; (iv) Geographic databases, spatial analysis and data dissemination; (v) Organizational and institutional issues; (v) GIS-based census mapping applications by GIS services providers.

8. For each topic, a number of presentations were made (see Annex 3). Presentations were followed by open discussion. All papers and presentations are available at http://unstats.un.org/unsd/demographic/meetings/egm/CensusMappingEGM07/default.htm). The concluding session focused on next steps and recommendations, drawing on highlights from the discussions presented by the Rapporteur.

9. The meeting was co-chaired by Mr. Kamara (Sierra Leone), Mr. Ari Nugraha (Indonesia), Mr. Fortes (Brazil), Ms Mwazi (Namibia), Mr. Trainor (USA), and Mr. Nairn (Australia). The Rapporteurs for the meeting were Mr. Chakravorty (India) and Mr. Kresovi (Canada).

II. Summary of presentations and discussions

10. The salient issues that emerged from the presentations and discussions are summarized in the paragraphs that follow. The summary is organized by topic, and reflects both the presentations and the ensuing discussions.

A. Institutional, organizational and capacity building issues

11. With regard to institutional, organizational and capacity building issues, the deliberations focused on three main issues: (i) setting up a permanent unit for cartography and GIS activities within the national statistical office (NSO); (ii) developing a partnership for cooperation with the national mapping agency and other organizations involved in geographic information activities; (iii) building technical and human capacities required for sustaining the census mapping programme.

12. The United Nations Statistics Division (UNSD) presented a paper introducing the conceptual framework that underpins the census mapping process and provided an

overview of the different implementation approaches countries may use in integrating geospatial technologies (GIS, GPS, satellite imagery, digital aerial photography, etc.) with census mapping operations, depending on their needs and resources available. The presentation stressed the institutional/organizational issues and stated that the critical issue was not technological developments but rather institutional arrangements within the countries; this included having a specialized in-house cartography/GIS unit with necessary technical and human capacities built through the provision of training and incentives for job retention. It is important that a national spatial data infrastructure be developed and maintained to better serve governmental organizations and their staffing capacity as well as other relevant stakeholders.

13. Australia made a presentation on capacity building for census mapping development, highlighting the following issues and influencing factors: (i) developing census mapping is a long-term strategy rather than a short-term operational issue, but there is also a need to implement short-term operational strategies; (ii) importance of establishing an efficient and effective infrastructure, where large gains in efficiencies can be obtained; (iii) importance of creating a single extensive operational map that can be used by all agencies; (iv) construction of a National Spatial Data Infrastructure which include the main components, effective governance, data availability, data quality, and access and standards.

14. A representative of the Secretariat of the Pacific Community (SPC) provided an overview on the situation of census mapping in three areas, Micronesia, Melanesia and Polynesia, stressing the fact that the focus is on the situation within countries, and not the territories under USA and France jurisdiction. The main problems faced in the 2000 round census included financing, skill shortages, limited external technical assistance, and retaining trained personnel after the censuses. In addition, population censuses were not included in the national budget and, therefore, there was heavy reliance in the region on donor funding. In terms of the overall census mapping process, pre-census mapping was done late or it was done without proper GIS capability; this aspect was somewhat given low priority by NSOs, and collaboration with other government agencies was very difficult.

15. The USA representative indicated that they had many strategies of hiring and retaining staff, one of which is the reputation of the US Census Bureau and in general, they did not have any problems in hiring or retaining staff. The U.S. also puts in a lot of efforts to recruit geographers and specialists from specific schools with good degree programmes. In addition, they have a very good active student programme with paid summer internships, and they work in conjunction with universities, making it possible for recruits to get credits alongside the work. The U.S. representative also referred to a website that promotes the development of technology careers including one that related to geospatial studies.

16. Many participants stressed the importance of sustainable capacity building in census operations and particularly in relation to GIS in developing countries. It was highlighted that the need of retaining a GIS qualified staff exists everywhere, even in developed countries. Some participants from developing countries, particularly from Africa, stressed

the fact that even when skilled staff is available, hiring is a problem, given the fact that traditional hiring procedures are ineffective.

17. Two specific cases were presented by Trinidad and Tobago and SPC representatives. It was noted that, in the Caribbean region, some statistical offices lost most of their staff after providing them in-house training because people quitted to earn much higher salaries in private companies. The Trinidad and Tobago representative mentioned that in order to curb this trend, they have shifted strategy towards stable, longer-term, three-year contracts which has proven effective (as it is very difficult to raise salaries only to GIS staff).

18. For the SPC region, it was stressed that the problem is not capacity development but rather retaining the developed capacity as well. Several NSOs in the region are indeed understaffed and many experienced staff left to join the private sector, go abroad, join other government agencies, etc. The SPC representative has proposed some remedies that would help retain staff: 1) Parity with other government offices; 2) Setting up career development; 3) Providing greater responsibilities and meaningful tasks to staff.

19. Other national experiences related to institutional and capacity building issues in GIS-based census mapping operations, include (i) establishing a collaboration agreement with a technical university in the country in order to provide a recognized training curriculum; (ii) encouraging private-public partnership and user-producer relationships; (iii) sensitizing Governments to the relevance of spatially referenced data for decision making and maintaining responsibilities concerning sufficient funding and staffing of census related activities; (iv) encouraging NSOs to participate in the development of National Spatial Data Infrastructure.

20. A suggestion was made that the cost and planning issues be highlighted as considerations, particularly for developing countries with regard to: (i) implications for using new technologies in terms of maintenance; (ii) existing alternative technologies available that accommodate budgets of a given country or office- is it necessary to spend limited resources on the latest technology? (iii) lessons learned in terms of advantages and disadvantages of the different technologies; (iv) comprehensive budget development for census operations in order to avoid donor fatigue with endless funding requests. This may be addressed through help of a consultant to develop a census plan and budget to ensure comprehensive spending needs structure.

21. A participant argued that UNSD should be prepared to convince governments in these countries to support the development of GIS capacity. Another replied that it is not International Organizations role to convince national governments to adopt a particular technology, rather to show all the benefits (as we do in this meetings), and develop relevant materials.

22. The UNSD representative explained that UNSD is to be regarded as a catalyst rather than an enforcer. It was stressed that the UNSD gives background information and makes a point of the need for doing this kind of work. This meeting and UNSD work is to assess the capacity in countries and publicize NSO's work.

23. The UNFPA representative discussed the workshops they conducted in Africa (i.e. Cameroon) with the purpose of participants to understand and convince their governments about the importance of what they are doing in their work. In ths regard , it was mentioned that the changes came from within the country and not from external organizations such as the UNSD, UNFPA or others. Another UNFPA representative stressed the problem of "brain-drain" in the area of census mapping, and explained that NSOs should not be discouraged about this problem. Even though they are short-staffed, they should encourage staff about the need of the nation to do this kind of work and build capacity to stimulate this sentiment. Collaboration of expertise (sharing experts) among countries with low capacity is a way of solving this issue.

24. In addition, the UNFPA representative pointed out that NSOs have the power to influence their governments to support statistical capacity development through the Statistical Commission (which is an inter-governmental body). It was added that there is a need to brief their representative on the Statistical Commission in order to have a recommendation on census geography with GIS that can back the country in its implementation of a GIS-based census mapping programme. International Organizations can support this process but not initiate it or lead it in each country.

25. Regarding the development of a National Spatial Data Infrastructure[1] and technical capacities, the USA representative, after finding that seven out of the 22 participating countries have built their NSDI, stated that there is a need to be careful when implementing that infrastructure while the census deadline is approaching. He also noted that USA tries to do most of the work within the GIS unit, and collaborate with the IT. However, GIS needs to be more technically capable no to rely too much on IT people to be more efficient.

26. Some participants were interested to have more information about some background material on National Spatial Data Infrastructure (NSDI) concepts and definitions. It was noted that they can contact UNSD to provide them with relevant material on the issue

27. There was a general recognition that census mapping, in reality refers to census geography and the meeting underscored the importance of ensuring commitment, at the executive level, for census geography development in a country or area.

28. Some other questions were raised about United Nations involvement in Cartography and Geographic Information activities at the international level. The UN Geographic Information Working Group (UNGIWG) and the relationships with some international organizations active in geographical information activities like the International Cartographic Association (ICA) were mentioned. A UNSD representative reported that

[1] NSDI is a combination of technology, policies, standards and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data. Conceptual parts of NSDI: 1. Institutional framework defines the policies, legal and administrative support to create, maintain and apply the standards to fundamental data sets; 2. Standards define technical characteristics to fundamental data sets; 3. Fundamental data sets require geodetic framework, topographic and cadastre data bases; 4. Technological framework allows the users to identify and receive the access to fundamental data sets (GSDI Cookbook, 2000).

UNSD is in charge of the organization of the UN Regional Cartographic Conference for Asia and the Pacific (every 3 years) and for the Americas (every 4 years) as well as UN Conferences on the Standardization of Geographical Names (every 5 years) and UN Group of Experts on Geographical Names meetings (3 sessions in 5 years). It was noted that UNGIWG, created in 2000, is an umbrella group coordinating geographical information activities of UN bodies, and ICA is an NGO which coordinates activities with National Mapping agencies and an active participant in the UN Regional Cartographic conferences.

B. Use of GIS, GPS and other geospatial technologies for census geography

29. With regard to the use of Geographical Information Systems, Global Positioning Systems, Remote Sensing, and Internet, many participants stressed the capabilities and potential offered by these technologies to support and improve census mapping operations, and underscored the fact that geography is very important for the census and inherently, mapping is very crucial for census operations.

30. The USA representative presented a paper on the use of geospatial technologies for census data collection and highlighted some of the issues to take into account when considering use of new census mapping technology, such as: (a) the strategy to adopt in terms of whether to use commercial products-have the products developed in-house or do you adopt a hybrid approach?; (b) the extent to which commercial products satisfy user requirements; (c) the need to develop partnerships with vendors of commercial products in order to ensure that the user gets the type of software that is needed; (d) the performance of both the software and database should be scaleable in that it is able to grow; (e) whether the software can meet the requirements for the planned activities in terms of production and schedule of activities; (f) the availability of local support from the vendor to provide any needed support in a reasonable amount of time; (g) the need to establish good communication with vendors; (h) plans for extra budget to cover costs required for fast turn around.

31. Other important guidelines from the presentation included: (a) partnerships with other agencies or stakeholders is very important both for the development as well as maintenance of the geospatial data; (b) an appropriate workforce must be available to carry out the work; (c) there are many types of available technology and care must be exercised in making the appropriate choice for the country on what to use; (d) an appropriate budget for project should be developed: over-budgeting is preferable to under-budgeting to ensure availability of adequate funds; (e) accompanying metadata for the geospatial data in very critical; (f) talking to others and learning from them in order to share expertise and good practices is very important; (g) keep it simple.

32. South Africa made a presentation on its experience with census mapping and the use of geo-spatial technologies**.** The presentation noted that for the 1996 and prior censuses, South Africa used hand drawn enumeration area boundaries on paper maps for data collection. The results of the 1996 were digitized using Supercross and this formed the basis for the development of digitized maps for most of the country for the 2001 enumeration area demarcation. Presently, South Africa is working on developing a

Dwelling Frame and a digitized map for the whole country, including rural areas with no address system that will form the basis for EA demarcation and an electronic listing of dwellings for census enumeration.

33. Australia highlighted how GIS technologies were used for the design of census collection districts and map production for the 2006 Australian census. Using GIS technologies, the 2001 boundaries were adjusted for changes to create the 2006 census collection districts. The Public Sector Mapping Agencies, a consortium of Federal and State Mapping Agencies (PSMA), has built and maintains a national topographic database at a scale suitable for census mapping. The Australian Bureau of Statistics (ABS) uses digital mapping information from the PSMA database.

34. It was mentioned in the presentation that the development of GIS capabilities has contributed to more efficient censuses by: (i) Using GIS to assist in the design of census collection districts; (ii) Producing excellent maps to aid the collection process; and (iii) Producing quality statistical geography for analysis and dissemination. It was pointed out, however, that GIS will only save costs if there is a reliable source of suitable data and a core section of people with well developed technical skills. Also, these data sources require some institutional development over an extended period.

35. The SPC presentation also showed the case of Marshall Islands as a good example of integration between GIS and Satellite Imagery using small handheld mobile GPS with high resolution satellite imagery. In 2006, Marshall Island conducted a socioeconomic community survey (1205 household with data collected on 9,491 individuals) which allowed mapping of diarrhea incidence with location of public dumpsters.

36. The presentation by Geospace International (a geospatial technology services provider from South Africa) explained the type of work that they do and the kind of technical support they provide to African countries and developing countries in census cartography services and products. They particularly worked on the 2001 census of South Africa, and their major focus is on the use of satellite imagery and digital aerial photography for census mapping operations.

37. The presentation by ESRI (GIS producer from USA) focused on their new products and their features. There was a lot of interest from the Group on the new products of ESRI, such as the Arc GIS Explorer, which the presenter said will be available in 2 weeks time. ESRI representative also informed that Windows Workflow will be available in version 9.3. There was also interest in the papers from the last ESRI user conference. The ESRI representative explained that there is product life-cycle information on their website to help users determine the routes they can take to update their GIS software.

C. Geo-coding concepts and definitions, and coding schemes

38. With regard to geo-coding, the participants stressed the fact that coding census information on a geographic basis is a fundamental component of census geography. The deliberations focused on three mains issues: (1) the need to agree on a common definition of geo-coding for census purposes; (2) the need to clarify the level of geographic features

for data collection and dissemination purposes; (3) the different methods to use in geo-coding information in Population and Housing Censuses.

39. The United Nations Statistics Division presented an overview on geo-coding concepts and definitions and the different methods to geo-coding pertain to Population and Housing Censuses. The presentation examined definitions of geo-coding at conceptual and operational level. It gave an introduction to the practice of geo-coding and described the two approaches relating to data collection: the 'direct collection approach' and the 'matching approach'. The presentation analyzed the strengths and weaknesses of geo-coding, highlighted the opportunities which geo-coding offered, but stressed the importance of having highly trained staff for process to be successful.

40. The participant from the Philippines provided a summary of the country's experience with geo-coding during the 2000 census based on digitized aerial maps. The presentation detailed the problems encountered during the process which were based mainly due to inaccuracies of maps delivered by a private contractor and adverse environment during fieldwork which lead to big delays in completing the work. The presentation stressed the importance of updating and verifying maps and delineation of geographical units well before the actual census enumeration. It also emphasized the need for a sufficient budget for future mapping operations and the importance of more detailed and better labelled maps for use by enumerators during fieldwork.

41. The representative of Namibia described the coding scheme developed by the Central Bureau of Statistics in Namibia and the current status and future developments in using GIS as a tool in the process of moving away from the traditional methods of mapping for censuses and surveys to digital mapping. The main aim of their geo-coding and census mapping using GIS was to facilitate the production of base maps needed for fieldwork. The presenter also illustrated web-based dissemination tools which can serve to support and improve regional planning.

42. The expert from Portugal made a presentation on the development and use of geo-coding. She described the coding scheme established by the National Statistical Institute of Portugal and summarized the main steps undertaken during the digital mapping for the 2001 census and discussed the strategy and the methodologies which will be followed in creating a digital geographic referencing system for the census 2011. The presentation stressed the need to replace the previously used coding scheme with a more updated and adaptable geo-coding methodology.

43. An expert from the Department of Geography and Center for Demography and Population Health, at Florida State University, described the theory and concept of geo-coding, in particular place hierarchies of different kind, as well as applications, limitations, and future developments of geo-coding. The presentation suggested updates for the United Nations "Handbook on geographic information systems and digital mapping" which includes need to update the software section with special emphasis of the fast developing market of open source products, including a discussion on the assessment of data quality. She also argued for inclusion in the handbook of more updated cases studies.

44. The experts discussed at length the need for a generic definition of geo-coding that took into account places without street names and numbers. In this connection, the experts came up with broader definitions which put emphasis on the coding of any geographical object or feature. It was advised that the new version of the "Handbook on geographic information systems and digital mapping" should include such definitions.

45. Many experts stressed the importance of establishing and using a common geographic reference system within the country as it is a basic component of the National Spatial Data Infrastructure. For census and survey purposes, this frame shows the relationships between the different spatial entities and forms the basis for data collection and dissemination. In addition, a well maintained geographic frame enables the comparison of statistics geographically over time.

46. The issue of how to deal with different reference systems (e.g. GPS vs. digital maps) was also raised. In this context, one delegate stated that it was the practice in his country to follow the map and note a deviating GPS location as metadata. In this regard, the experts also stressed the necessity to distinguish between the concepts of geo-referencing and geo-coding.

47. Some experts warned about technical complications which arise when a point reference system is used instead of a polygon reference system. While other experts stressed the significance of geo-codes as purely statistical entities to which other codes – like political or administrative codes can be linked as necessary.

D. Level of geographic features for data collection and dissemination

48. The level of geographic features for data collection and dissemination was alluded to by many participants.

49. A question was raised as to whether the frame for geo-referencing should be at the dwelling or household level. It was explained that in the case of South Africa, although the debate is still going on, it is expected that the dwelling level will be the standard for all censuses and surveys as this is more stable than having a household geo-referenced frame.

50. The USA representative stated that they are using two kinds of geography: a geography for data collection and another for data dissemination with specific geographic features for each. He stressed the importance to go beyond census mapping operations and need to develop a census geography strategy.

51. In Canada they follow the US approach. In this regard they created a national network of blocks for dissemination, which is based on population and dwelling counts. For 2001 census, they adopted a block program as part of which they develop low level dissemination data which was a grouping of blocks to release socio-demographic and economic data without compromising confidentiality requirements. This low level dissemination areas were used for collection and dissemination. The boundaries were based on transport and enumeration areas, and not detailed spatial data (such as hydrographic data). For the 2006 Census, their focus was on business process

reengineering of the overall census collection process and mapping. For 2011, they are considering a review of metropolitan and urban area.

52. Addressing a question on enumeration areas, Australia representative said that EA are used only for enumeration purposes and are estimation, and mesh blocks are only for sharing of data and dissemination.

E. Enumeration areas (EA) design

53. The methods of demarcating enumeration areas (EAS) and their determination were presented and discussed.

54. In this connection the participant from Sierra Leone made a presentation on the use of GPS to delineate enumeration areas as a convenient solution for developing national sample frames. In his presentation he indicated that there were no digitized maps prior to the 2004 census and available maps were outdated. Thus, administrative and other boundaries were not in digitized form and were either drawn wrongly or had been changed. Maps had to be updated by visiting localities and entered into a computer as well as on a field form including GPS coordinates of administrative boundaries and of social infrastructure. At the same time, household counts of local areas were carried out and based on this information demarcation of enumeration areas was conducted. Maps of EAs were scanned to produce computerized versions and then digitized. The EA database will be used as a statistical sampling frame for future socio-economic and demographic surveys and for other administrative purposes.

55. The issue of an ideal size of an enumeration area (EA) was discussed. In general, one enumerator should be able to handle one EA entirely, though some countries have a backup system in place. Thus, the size of the EA is usually based on the number of households in this EA but also needs to take into account travelling distances and the relevant transportation infrastructure.

56. Concerning the creating of enumeration maps experts expressed the necessity to keep the maps simple and include just the information necessary for the enumerator to orientate him or herself of the enumeration area in order to avoid confusion and/or delays.

57. Some specific questions were raised about mesh blocks: what is the technology behind the development of mesh blocks? How are they maintained and how are they used for collection and dissemination? Whether the mesh blocks are related to the estimation of the surface area, or only the enumeration area?

58. The Australian representative responded by stating that in essence mesh blocks are composed of 30-60 blocks which are made to fit with the cadastral parcels and the transportation maps, and they are used for sharing information among agencies. They cover the whole country and there are no overlaps in the boundaries. To construct them, it is necessary to have a basic block map and after creating the mesh block, and after double-checking with imagery for refinement. In terms of the maintenance system, it is still under development, but basically it is going to be based on street addresses and

cadastral parcels, and they are going to split mesh blocks when the population inside increases, or collapse them when the population decreases. They will keep a number in the system which allows them to identify the parent-child relation.

59. Methods were discussed in how to enumerate nomadic population and the floating population in general. It seems to be common practice to gather information about the usual whereabouts of such sub- populations from local authorities in advance and then enumerate the population, using sufficient manpower in a single night.

60. The SPC representative stressed the need to redefine EAs for the next round of censuses in the Pacific region, as no digital maps have been used in EA definition.

F. Geo-coding census data and confidentiality issues

61. Regarding ensuring data confidentiality, enumerators using handheld devices, in Brazil for instance, do not unlawfully download the information from the personal digital assistant (PDA). It was explained that data are encrypted and can only be transferred to the IBGE through a special network. Regarding the confidentiality of GIS data, the answer provided by Australia and others is that statistical data are confidential, spatial data were not.

62. It was argued that the development of a dwelling frame, in the case of South Africa, also raised the issue of confidentiality concerning address data of housing units. It was pointed out that address data is not confidential per se and should be made available. It was argued that confidentiality concerns come in only when the address data is linked to data on individuals. In order to ensure preservation of data confidentiality, the representative from Russian Federation pointed out that lower level data are available only to authorized users.

63. Experts also discussed the issue of confidentiality when the names of household heads are included in the referencing of dwellings, a practice used to identify dwellings for which a formal address such as street names and numbers are missing. In such cases confidentiality is protected by dropping the name of the head of household when data are disseminated.

G. Database conceptual framework

64. The United Nations Population Fund (UNFPA) representative gave an introduction to the different steps needed in the development of an Enumeration Area Database. The conceptual framework of the development was described as follows: at the beginning of the process is the design and formulation of the desired Enumeration Area (EA) products this is followed by arriving at the decision for a special EA database model. Only after this process is undertaken can the necessary data be gathered and captured. The data are then compiled, manipulated and catalogued to form spatial datasets which are then managed in a Database Management System. A typical database schema would consist of feature classes, feature datasets, tables, raster datasets and raster catalogues. Using an

example of Afghanistan, the UNFPA representative showed the products of an EA database.

65. Lessons learned from the development of an EA in places such as Afghanistan related to: difficulties when geographic coordinates and map data are treated as 'classified'; the trade-off between traditional census mapping methodologies and digital mapping approaches; questions of international census mapping ethics/standards and target delivery in hazardous work environment; questions of enumeration area size and duration for actual census canvassing; decentralization versus centralization in the context of census mapping activities.

66. The representative of Morocco made a presentation on the development of a geographic database and spatial analysis with regard to the 2004 national census. The presentation described the experience of Morocco in the cartographic activities and the setting up of a geographic information system. The main objectives of the cartographic work were to: cover the national territory with recent reliable and exhaustive maps; partition the national territory into census districts to ensure the exhaustiveness of the census; endow the data collection with accurate cartographic documents assuring easy localization of the different observation units at the time of census execution; collect geographical information required for an adequate census management; build up a geographic information database for the inter-census programme of household and population surveys.

67. The presentation stressed the different methodologies needed to cover urban and rural areas due to their unique characteristics. The main difficulties encountered included: insufficient cartographic coverage; frequent changes in boundaries of communes; incomplete systems of addresses (in particular in the peripheral districts and rural areas), incompatibility of the douars "villages" with land partitioning (because the "douar" is more an ethnic than a geographical concept); lack of coordination between the different departments that were producing the geographical information; finally, the reality of relying on insufficiently skilled staff to do the cartographic work during peak times of cartographic activities.

68. Other reported national experiences related to the development of EA databases for census enumeration highlighted the difficulties and costs of the GIS implementation. In general it was agreed that national statistical offices benefited from the new maps because they have provided an essential control facility that guaranteed consistency and accuracy of the census, support data collection, and help monitor census execution by allowing census takers and surveyors to more easily identify their assigned set of households.

H. Maintenance of geographic features, geographic databases and related software

69. Discussion centred on the issue of the stability, or lack thereof, political and administrative boundaries and the implication of changes for a geo-coding system. Changing boundaries cause problems because the coding system may be created in a way that does not allow the inclusion of additional geographic units (for example after

splitting a unit into two). Furthermore, changing boundaries and modifications of the geo-coding system may make comparisons over time difficult because of a lack of congruency. To account for split units some experts suggested a system of geo-codes which leave space to expand (e.g. by having digits in the code without current information).

70. Other experts pointed out that it is necessary to keep statistical and political boundaries independent. Additionally, the decoupling of collecting from dissemination units increases the flexibility to respond to changes of political or administrative boundaries and sustain a comparability of statistical data over time. In view of the above, experts stressed the importance of keeping at least one geographical unit on a low level stable in terms of its boundary that should not be changed, altered or retraced even if political or administrative boundaries are changed.

A specific question was put to Australia as to how changes in city boundaries would affect data comparability over time. Although the data may not be comparable over time, they provide concordance tables for the data users. Also, Australia, in the future, expects to code the data at a smaller unit level than the enumeration area that would create more stability.

71. A question was raised on how to ensure the quality of a specific GIS database when relying on regular IT programmers with no experience in designing and maintaining GIS databases. For example, fine-tuning queries on a regular database is not the same as fine-tuning a GIS database environment. How to handle that? How to ensure continuity of the IT development process when staff are external to the census cartography unit? In Australia, the staff is not involved in all parts of mapping but only to the extent that the information is sufficient for the development of the census framework. The USA representative pointed out that they try to do most of the work within the GIS unit, and collaborate with the IT in the Geography Division. However, GIS need to be more technically capable no to rely too much on IT people to be more efficient.

72. A specific question for Sierra Leone was raised regarding the possibility of disputes between neighbouring administrative regions in the course of establishing coordinates of administrative boundaries. It was explained that establishment of the boundaries was carried out in consultation and with the agreement of all parties involved.

73. Sierra Leone was also asked to explain whether a back-up system was available to avoid loss of information if there were technical problems with the system that prevented the transfer of geospatial data from the field. It was explained that to avoid loss of information, the captured data were recorded both in computer form and on a paper field record forms.

I. Quality of data and combination with other sources

74. On the use of geospatial data from other agencies, a question was raised regarding concerns to the quality of the acquired data and also on the issue of cost recovery. It was explained that for the US, for instance, the Census Bureau evaluates the quality of the data from private sources. Also, in the USA, all data are potentially provided to the end

users free of charge. Furthermore, a written agreement is signed with providers of data to avoid high acquisition fees. There were also reciprocal arrangements between the US Census Bureau and State Governments that make it easier for the former to get the information free of charge. Although all acquired geospatial data can be potentially released, some are not accessible to users if they are of a sensitive nature.

75. During the discussion which ensued it was pointed out that in the USA, the process of updating the address lists is done through a consultative process with local governments as there is no national address system. Local authorities are sent address lists of their areas for review and update. During the address canvassing operation by the US Census Bureau, modifications are made to the list based on comparisons of the information obtained by the local authorities and what field staff observe on the ground.

76. Referring to the presentation of the Philippines, experts raised the issue of using Google Earth products and expressed some concern about its accuracy. Some expressed their opinion that the potential utility of these products may still be worth exploring. The combination of census data with other sources was also stressed by many experts.

77. The Indian representative reported on the use of DevInfo (a database system, developed in cooperation with the UN system, which monitors progress towards the Millennium Development Goals) and its adaptation for its needs. A question was raised about the existence of any procedure to protect spatial data (which is not in the public domain) as tools such as DevInfo are disseminated very easily to the general public. He pointed out that DevInfo has an Admin Module to define security of what is going to be disseminated. India doesn't give anything for free and they charge for whatever is delivered. The Indian representative stated that census boundaries files are very popular and many government, agencies, research institutions, universities, etc., are buying them.

78. A question was raised about the consideration of geographic data as public domain as reported by the USA. One expert noted that this is a policy issue and reported that for example in Australia, Federal data is free but state data is not. He also said that the Australian Bureau of Statistics has staff located in other agencies who work as focal points and ensure that a close relationship exists with the agencies and that stimulates data collaboration.

79. The need of outsourcing was raised by USA and other experts, as well as the need to evaluate private sources and to outsource for PDA devices. For the 2010 US census, setting up of field infrastructure for the use of PDAs has been contracted out.

80. The Russian Federation representative asked the USA, Australia and Canada representatives how do they proceed to identify population living in high-mountains or difficult terrain? It is politically very important for this population to know how many they are and what their living conditions are. Regarding the concern about people in remote areas, the Australia representative responded that they trust in local collectors with local knowledge. Census collectors are based in the nearest towns: however he also noted that they don't really have nomadic and hard-to-reach populations, so it's not really an issue in Australia.

J. Link of Population Census with Agriculture Census

81. Brazil and Mexico showed some GIS-based applications related to the agricultural census. For Brazil, some innovations were introduced during the 2007 censuses- the Agriculture Census and the Population Counting - where there was use of a national address file for statistical purposes and also the use of personal digital assistant (PDA) to replace the traditional paper questionnaire for data collection. Digital maps for the 2007 censuses were based on updates of those developed and used in 2000 Census of Population and Housing. Cartographic updating of the information was carried out by use of the Municipal Maps Semi-automatic Elaboration System (SisCart). The experience acquired from the 2007 censuses will be used in the development of the 2010 census mapping strategy.

82. The Russian Federation representative made a presentation on GIS technologies in the All-Russia Agriculture Census of 2006 and noted that cartographic work was based on digital maps and also on data obtained by use of remote sensing technology. GIS is used for data analysis and presentation and digital maps are used during the intercensal period for sample surveys. The lesson learned from the mapping activity was that there were discrepancies in information from different agencies: such as between those responsible for cadastre and those for agricultural arable land..

K. Disaster management

83. Some experts noted the specific difficulties in preparing censuses and collecting geographic data in war torn countries like Sierra Leone in the past or in present Afghanistan.

84. The SPC representative stressed that there is a growing demand for small area data (village level), below the standard census collection unit levels (EA). The need for village level population and housing data is required for assessing, monitoring and managing disaster preparedness, given the Pacific islands' annual exposure to cyclones, as well as the very imminent threat of sea level rise. One example was the recent Tsunami for which no village information was available to organize relief efforts in the potentially affected areas.

85. Experts stressed the fact that the use of geospatial technologies for the production of small area maps is useful for immediate response and countries should compile such data proactively rather than reactively. There is a recognition that this field needs to be further explored and called for the strengthening of spatial census information systems that can support natural disaster response and recovery.

L. Dissemination issues and census advocacy

86. The presentation on web mapping for the dissemination of census data was demonstrated through the Canadian experience in their methods for disseminating geographical census data on the web. The presentation described the web as the key medium for the dissemination of census data. Statistics Canada disseminates all standard geographic products and all data highlight tables on the Web. The presentation stated the

main benefits of web dissemination were that it improved timeliness, increased accessibility of products, had a broader reach for products, and increased usability of data.

87. The challenges of web dissemination were: the diversity of the user community (including increasingly non-specialists); increased demand; format selections; considerations about the amount and content of metadata provided; high user expectations. The presentation identified the following lessons learned from web mapping: need for common look-and-feel standards on the webpage; use of a common engine for many applications; need to enhance accessibility to data; to integrate products; ability to scale the underlying processing architecture.

88. The representative of Statistics Canada made a demonstration of their website and how they organized information under the heading Maps and Geography. They took the Group briefly through their development of the interface, which was done in-house by Statistics Canada in four months by one programmer. Their main guiding principle was to keep it simple. Other guidelines and advice given included: (i) Look at what is already out market (for example, they examined Google map, MapQuest, etc.) and do not reinvent what already exists; (ii) Focus on your real need; (iii) Make it easy to use and accessible to all, i.e. universally understandable.

89. The presentation by India gave an overview of the country's experience in establishing a GIS database and in particular, in using a digital geographic database for dissemination. The post-census mapping included the preparation of various types of thematic maps at different geographic levels. These maps were used in checking the quality of census data before publishing the results by comparing 1991 and 2001 Census data. In addition, a number of publications were based entirely on maps (atlases). Furthermore, Indian Census developed several GIS applications for disseminating census data: CensusInfo India (on CD), which is based on the no-cost software ChildInfo/DevInfo, Census GIS Punjab (on CD and internet), Census GIS India (on internet).

90. The presentation stressed the importance to keep in mind the target users and their needs before any GIS application is developed. The presentation identified three major considerations in this context: to limit the information to be packed in one application, to make the application focused and user-friendly, and include regular interaction with the data users over a period of time which gives clues about the need for development.

91. Many experts stressed the importance of advocating census taking and in particular the use of new census related technologies like GIS in presenting information to policy makers for use in informed decision making. A GIS based dissemination of census data would help save costs, improve data management, lead to better decisions (due to faster information access), and enhance capabilities by putting new applications in place

92. In terms of using GIS for data dissemination and utilization, the SPC representative commented that there was the need to simplify the presentation of population data and SPC developed customized software (Population GIS) for statisticians and planners. The

presentation showed an example on Population and Malaria mapping and stated that eight national systems are using the software.

93. In response to a question as to whether users can custom-design their own area by combining census blocks, the Canadian representative responded that they currently do it internally but would like to look into making that feature available to users in the near future. He also explained that right now the mapping and geography dissemination is limited to census—no plans yet to apply them to other statistical sources like administrative data.

94. In relation to the issue of web dissemination experts agreed that the implementation of a comprehensive dissemination system is problematic in terms of human resources because there is need to maintain, and updating the system. In addition, you have to maintain correspondence with the client which can be very labor-intensive. An additional issue is the probable limited accessibility of such dissemination tools in areas with a low bandwidth and dial-up internet access.

III. CONCLUSIONS & RECOMMENDATIONS

A. General

95. The use and application of contemporary geo-spatial technologies and geographical information systems (GIS) has opened a new chapter in all the phases of undertaking population and housing censuses, thus improving the efficiency in all of the pre-enumeration, enumeration and post-enumeration phases. Consequently, the meeting recommended and strongly supported the use of these technologies for the 2010 round of population and housing censuses, taking into consideration national and local circumstances.

96. In order to achieve the best possible improvements in integrating geospatial technologies with census mapping and to build sustainable frameworks, the participants underscored the need for the national statistical authorities to undertake the following steps:

a) Develop and set-up institutional and organizational structures to implement a census geography programme;
b) Ensure the availability of adequate resources to that end;
c) Institute and maintain training programmes for national staff;
d) Develop mechanisms for retaining GIS trained staff;
e) Actively participate, in partnership with other national authorities, in the development of a national geographical information capacity, including the National Spatial Data Infrastructure.

97. The meeting emphasized the need to exchange national experiences in the area of census geography and urged the United Nations Statistics Division to continue organizing similar meetings, at international and regional levels, thus ensuring increasing technical interchange and strengthening of national capacities. The United Nations Statistics

Division was also requested to introduce an on-line facility and other media, including e-learning material for ensuring pervasive exchange of knowledge. In addition, the meeting suggested additional venues for meetings and technical discussions through a Commission or Working Group of the International Cartographic Association (ICA) in which the United Nations can and should be an active participant. Such arrangements would complement the efforts of this meeting and contribute to the development of census geography worldwide.

98. Underscoring the fact that these new geo-spatial technologies require mobilization of significant resources at national levels and commitment of national governments, the meeting called upon the United Nations Statistics Division with other United Nations agencies to compile lessons learned on the advantages as well as limitations of different technologies and facilitate the development of guidelines for national statistical authorities that would enable them to articulate their needs and mobilize resources.

B. Use of contemporary technologies for census geography

99. The meeting discussed at length different approaches to the use of contemporary technologies for census geography. The wealth of experiences leads to the conclusion that the application of these technologies is without exception beneficial to the efficiency and the quality of population and housing censuses. However, the meeting recognized that a single solution would not fit all national circumstances. Consequently, the meeting recommended that the United Nations Statistics Division, in further implementation of the 2010 World Programme on Population and Housing Censuses, needs to document best practices and describe different applications.

100. The use of contemporary geo-spatial technologies such as satellite imagery, aerial photography, Global Positioning System (GPS), and GIS consistently improved census components, e.g. the delineation of enumeration areas for population and housing censuses, the supervision of the data collection process and dissemination of data at small area levels. These improvements are also crucial in terms of planning disaster management, as they allow for a flexible and integrated approach to information sharing pertaining to the affected areas. In addition, these technologies can facilitate quick collection and effective dissemination of information following the aftermath of a disaster. In this regard the experts reiterated that the applications of these technologies are of strategic importance and clearly go beyond the national statistical systems.

101. The meeting recognized that some of the geospatial technologies described above require significant availability of resources and technical support; thus, statistical agencies need to consider prospects of the capability to maintain the technology before making decisions to adopt them.

102. National practices in building up a robust basis for census geography relied on a symbiotic efforts within the national statistical authorities and outsourced contractors, as well as of partnership with national geographical authorities. Consequently, the meeting recommended this approach as an efficient paradigm.

103. The meeting noted with appreciation the presentations of invited corporate providers of these technologies and encouraged the United Nations Statistics Division to continue this practice of inviting the corporate providers to meetings, as it provides a welcome opportunity, for participants, to be directly briefed of the most recent technological developments and their applications.

C. Geo-coding for statistical purposes

104. The meeting discussed in great detail the definition of geo-coding. On a very general level, geo-coding is defined as associating geographical coordinates to geographical features, such as structures, buildings, dwellings, streets, addresses, enumeration areas. Participants outlined the advantages of geo-coding enumeration areas and lower level units down to buildings, as providing them with unique identifiers is critical in building up national sample frames and ensuring unique enumeration during the census data collection, for example. A number of national statistical authorities invested significant effort in this activity, with some of them geo-coding all dwellings and related addresses, while others doing so for enumeration areas.

105. Methods used for geo-coding enumeration areas, buildings, etc. also differed, with quite a few examples using GPS devices. The meeting also noted the use of satellite imagery, their segmentation and the combined use of Personal Digital Assistants (PDA) for collecting data and geo-coding. The meeting emphasized that geo-coding of features such as schools and health facilities, while important, should be carefully weighed against the critical demands of population and housing censuses as such additional work could distract from the primary objective of a census.

106. Irrespective of the geographic unit and of the method used for its geo-coding, the meeting recommended that national statistical authorities should consider the geo-coding approach for the 2010 round of censuses; the experts also pointed out that a difference need to be appreciated, in some cases, between the level of data collection units, which can be a building, and data dissemination areas, that need to be aggregated, as the confidentiality of individual information has to be of primary concern for national statistical authorities.

107. Participants emphasized the need to develop geographical coding schemes that can respond to the requirements of the use of contemporary technologies as well as maintain historical overview of small areas. If possible, efforts should be made to ensure that census geo-coding is consistent with existing coding systems like local administrative units. This would ensure comparability of information. A special emphasis was put on the criteria to be selected in the design of enumeration areas (such as population size, travel distance, etc.) and the evaluation of enumeration area maps by enumerators as a quality control procedure.

108. The importance of a Dwelling Frame/ Address Registry was emphasized by many participants in the meeting. The development and maintenance of such a frame is important for a census and other statistical exercises. Its development, maintenance and use need to be added to the documentation.

D. Geographical databases and data dissemination

109. The meeting recognized the value added of establishing detailed geographical databases of enumeration areas that would encompass the needs for census data collection, support the processing of census data, and would be directly linked to data dissemination for small areas. These databases need to consistently integrate in their database structures, census data with other geographic reference data, such as roads, rivers, landmarks, settlements, thus providing a critical base for disaster preparations. The participants noted that geographical presentation of statistical data significantly increased the interest of users, resulting in a better appreciation of statistical products and statistical work in general.

110. The meeting recognized the long-term commitment and efforts, in terms of resources, that are necessary for developing these databases and mechanisms for data analysis and dissemination; yet the value added more than justifies these commitments. In addition, experts identified the need to acknowledge and adhere to existing international and national standards and to develop and share new standard development such as statistical geographic product metadata.

111. The meeting recognized that there is pre-existing geographic data available, including commercial data. However, these data must be analyzed prior to their inclusion into the geographic data infrastructure to support the census in order to assess their reliability and accuracy.

112. Participants noted with appreciation the presentations on the use of web-based tools for census data collection (e.g. enumeration areas delineation and locating missing dwellings), and particularly the web-based map viewers for census information dissemination to the general public, and stressed the need for national statistical authorities to develop their own web-based mapping tools.

E. Review and update of the current Handbook on Geographic Information Systems and Digital Mapping

113. The meeting emphasized that the current version of the *United Nations Handbook on Geographic Information Systems and Digital Mapping* still provided valuable guidance in this field; however, it needs updating and reviewing to take into account contemporary developments not only in technologies but more broadly, approaches to the use of geo-spatial applications for statistical exercises in general, and population and housing censuses, in particular. The update would emphasize the continuous process and use of census geography programmes, as opposed to the sequential mapping and dissemination operations. It would also build on the recommendations of this Expert Group Meeting.

Annex 1. Information Note

United Nations Expert Group Meeting on Contemporary Practices in Census Mapping and Use of Geographical Information Systems

Date: 29 May -1 June 2007
Venue: New York
Host: United Nations Statistics Division
Contact: globalcensus2010@un.org
Web site: http://unstats.un.org/unsd/demographic/meetings/egm/CensusMappingEGM07/default.htm

The United Nations Statistics Division is organizing an Expert Group Meeting on Contemporary Practices in Census Mapping and Use of Geographical Information Systems with a major goal of producing a Technical Report on Best Practices in Census Mapping and Use of GIS. It is one of the priority activities of the 2010 World Programme on Population and Housing Censuses for this year, 2007, that will provide a background material to support the regional workshops that the UN Statistics Division is planning to organize and conduct, starting in September 2007, as well as an input to the Handbook on Geographic Information Systems and Digital mapping, initially issued in 2000, that the UN Statistics Division is in the process of revising and updating it.

Purpose of the meeting

The purpose of the meeting is to critically review contemporary framework and different approaches to census mapping and the capabilities offered by advanced technologies (Geographical Information Systems, Global Positioning Systems, Remote Sensing, Internet, etc.) to support census mapping operations, with an emphasis on possible institutional, organizational and technological obstacles. Sessions will focus on detailed discussion related to 1) Geo-coding: concepts and approaches to related data collection, 2) Use of Global Positioning System and geospatial technologies and digital delineation of enumeration areas, 3) Geographic databases, spatial analysis and data dissemination and, 4) Organizational and institutional issues.

Key issues

The Expert Group will, aside from general discussion, specifically review and recommend some guidelines on best practices on:

1. ***Geocoding Systems***
   - The proposal is to introduce some definitions for Geocoding that are relevant for census mapping, and to review different methods of acquiring geocodes for units in a population and housing census.

2. ***Integration of geospatial technologies with Census Mapping***
   - The paper presents a conceptual framework for the integration of geospatial technologies, (GIS, GPS, Remote Sensing, Internet, etc.) with census mapping operations at the different stages of the census mapping process (data collection, data management and analysis, data dissemination).

3. ***Institutional and organizational aspects of a GIS-based Census mapping project***
   - The most critical obstacles for a GIS-based census mapping project are not only technical but also organizational and institutional.

Annex 2. List of Participants

No.	Country Name	Contact Person/Address
1.	Australia	Mr. Alister Nairn Director, Geography Australian Bureau of Statistics
2.	Brazil	Mr. Luiz Paulo Souto Fortes Associate Director of Geosciences, IBGE / DGC
3.	Canada	Mr. Joe Kresovic Assistant Director. Geography Division Statistics Canada
4.	Canada	Mr. Daniel Paquin Systems Chief, Geography Division Statistics Canada
5.	China	Mr. Xueqing Song Director of Division of Information Management, Census Center of National Bureau of Statistics
6.	China	Ms. Hongyan Cui Commisioner National Bureau of Statistics
7.	India	Mr. Chinmoy Chakravorty Joint Director, Office of the Registrar General and Census Commissioner
8.	Indonesia	Mr. Mohammad Ari Nugraha Head of Statistical Mapping Sub Directorate, BPS Statistics Indonesia
9.	Jordan	Mr. Abed Alosat Head of GIS Division, Department of Statistics of Jordan
10.	Kenya	Ms. Emma Akelo Odhiambo Head of Cartography / GIS Section, Kenya National Bureau of Statistics
11.	Latvia	Mr. Pavels Onufrijevs Head of IT Section, Central Statistical Bureau of Latvia
12.	Mexico	Mr. Mario Chavarria Director of Basic Information Instituto Nacional de Estadistica, Geografia e Informatica (INEGI)
13.	Morocco	Mr. Benkassmi Mohamed Head of the Division of Household Surveys, Direction de la Statistique, Haut Commissariat Au Plan
14.	Namibia	Ms. Ottilie Mwaalele Mwazi Chief Statistician,

		Central Bureau of Statistics
15.	Oman	Mr. Sameh Al Araimi GIS Department, Department of National Economy

16.	Philippines	Mr. Amador Trazo Information Technology Officer 1, National Statistics Office
17.	Portugal	Ms. Ana Maria Santos Head of Geoinformation Unit National Statistics Office
18.	Russian Federation	Mr. Alexander Bazarov Director of Department, ROSSTAT
19.	Russian Federation	Mr. Sergey L. Ipp First Deputy Director, Ministry of Agriculture
20.	Sierra Leone	Mr. Joseph Aruna Lawrence Kamara Statistician General, Statistics Sierra Leone
21.	Sierra Leone	Mr. Andrew Johnny Director of Census and GIS, Statistics Sierra Leone
22.	South Africa	Ms. Sharthi Laldaparsad Executive Manager Statistics South Africa
23.	Trinidad and Tobago	Mr. Harold Wall Manager of GIS, Central Statistical Office Ministry of Planning and Development
24.	Turkey	Mr. Hasan Aztopal GIS Team Leader, Turkish Statistical Institute
25.	Ukraine	Mr. Anatoliy Lyashchenko Deputy Director, Research Institute of Geodesy and Cartography
26.	United States of America	Mr. Tim Trainor Assistant Division Chief Geography Division, U.S. Census Bureau
Regional Offices/ Other organizations		
27.	UNFPA	Ms. Kourtoum Nacro Technical Adviser UNFPA,New York
28.	UNFPA	Mr. Bolaji Taiwo UNFPA-Afganistan
29.	SPC	Mr. Scott Pontifex GIS Programmer, CPS Secretariat Général de la Communanté du Pacifique

30.	ESRI	Ms. Carmelle Terborgh Global Affairs ESRI, USA

31.	Geospace International	Mr.Philippus Jan Minnaar Director, Geospace International (Ltd) South Africa
32.	Florida State University	Ms. Lisa Jordan Florida State University
33.	UNSD Consultant	Mr. David R. Rain Assistant Professor of Geography and International Affairs The George Washington University
United Nations Statistics Division		
34.	United Nations Statistics Division	Mr. Jeremiah Banda Chief Demographic and Social Statistics Branch UN Statistics Division New York
35.	United Nations Statistics Division	Mr. Jean-Michel Durr Chief Demographic Statistics Section UN Statistics Division New York
36.	United Nations Statistics Division	Mr. Srdjan Mrkic Statistician Demographic Statistics Section UN Statistics Division New York
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44.	United Nations Statistics Division	Mr. Diego Rumiany Associate Statistician Social and Housing Statistics Section UN Statistics Division New York
45.	United Nations Statistics Division	Mr. Jan Beise Demographic Statistics Section UN Statistics Division New York

Annex 3. Organization of Work

Tuesday, 29 May 2007

Registration of participants (9:30 a.m. – 10:00 a.m.)

Morning session (10:00 a.m. – 1:00 p.m.)

VII. 1. Opening

Introductory remarks by Director of UNSD

Purpose of the meeting, Branch Chief

Selection of Chair and Rapporteur for the meeting

VIII. 2. General Introduction

Overview Paper:

Presentation by UNSD (ESA/STAT/AC.115/1): ***Digital Census Mapping Process: conceptual framework and different approaches*** **-** a substantive presentation on different approaches to the integration of geospatial technologies (GIS, GPS, Remote Sensing, Internet Mapping, etc) with census mapping operations, highlighting possible institutional, organizational and technological challenges.

- Presentation of three GIS-based Census Mapping approaches**:**

A. South Africa experience (ESA/STAT/AC.115/2**)**

B. Australia experience (ESA/STAT/AC.115/3**)**

C. Brazil experience (ESA/STAT/AC.115/4**)**

- General discussion

Lunch break (1:00 p.m. – 3:00 p.m.)

Afternoon session (3:00 p.m. – 6:00 p.m.)

3. Geo-coding: Concepts and Approaches to Data Collection

Geocoding can be broadly defined as the assignment of a code to a geographic location. Usually however, Geocoding refers to a more specific assignment of geographic coordinates (latitude, Longitude) to an individual address. The purpose of this section is to introduce geocoding concepts relevant for census mapping and the different approaches to related data collection.

Overview Paper:

Presentation by UNSD (ESA/STAT/AC.115/5**):** ***Geocoding Concepts and Approaches to Data Collection***

A. Namibia (ESA/STAT/AC.115/6**)**

Geocoding and Census Mapping with GIS in Namibia: Current Status and Future Developments

B. Philippines (ESA/STAT/AC.115/7**)**

Geocoding and Census Mapping with GIS in Philippines: Current Status and Future Developments (*)

Discussion

C. Portugal (ESA/STAT/AC.115/8**)**
Development and Use of Geocoding: Portugal Approach

D. Ms Lisa Jordan (Florida State University, USA) (ESA/STAT/AC.115/9**)**
Geocoding and Census Mapping: Conceptual Framework and different approaches

Discussion

Reception (6:00 p.m. – 7:00 p.m.)

Wednesday, 30 May 2007

Morning session (10:00 a.m. - 1.00 p.m.)

4. Use of GPS and geospatial technologies for data collection, and digital delineation of enumeration areas

This session focuses on national experiences in the 2000 round of censuses in the use of GPS and other geospatial technologies for data collection, with a focus on the design of digital delineation of census enumeration areas. The papers will outline the procedures, software, devices and applications used, and address their advantages and disadvantages in conducting the census. Currently, a number of countries are exploring different approaches for the 2010 round of censuses and will be invited to share their findings with the Expert Group.

Overview Paper:

USA (ESA/STAT/AC.115/10**): *Use of Geospatial Technologies for Census Data Collection: Highlighting issues and influencing factors***

A. Russian Federation (ESA/STAT/AC.115/11**)**
Russian Experience in Geospatial Technologies-based Data Collection and Design of Digital Enumeration Areas

B. Sierra Leone (ESA/STAT/AC.115/12**)**
Use of GPS to Design Enumeration Areas: a Convenient solution for developing national sampling frames

Discussion

C. Ukraine (ESA/STAT/AC.115/13**)**
Digital Mapping for the 2001 Population Census in Ukraine: Lessons learned

D. China (ESA/STAT/AC.115/14**)**
China Approach to Digital Census Mapping

Discussion

Lunch break (1.00 p.m. – 3:00 p.m.)

Afternoon session (3:00 p.m. – 6:00 p.m.)

5. Geographic Databases, Spatial Analysis, and Data Dissemination

While not strictly limited to the preparatory phases of the population and housing censuses, the importance of developing geographic databases on population and housing represents a critical area of interest vital for the overall success of the census. Countries will be invited to present their experiences in the use of geographic databases and spatial analysis tools and techniques for the gathering of census data, with emphasis on obstacles and complexities in their development.

Overview Presentation:

UNFPA (ESA/STAT/AC.115/15**): *Development of an Enumeration Area Database: Highlighting Issues and Influencing Factors***

A. Morocco (ESA/STAT/AC.115/16**)**
Development of a Geographic Database and Spatial Analysis: Morocco approach to the treatment of the 2004 census results)

B. India (ESA/STAT/AC.115/17**)**
Development of Census-based Geographic Database Applications: India experience

Discussion

C. Trinidad and Tobago (ESA/STAT/AC.115/18**)**
GIS-Based Dissemination of Census Data in Trinidad and Tobago: A Caribbean experience

D. Canada (ESA/STAT/AC.115/19**)**
Web-based Dissemination of Census Data: Canada Experience

Discussion

Dinner, voluntary participation (6:00 p.m. – 8:00 p.m.)

Thursday, 31 May 2007

Morning session (10:00 a.m. - 1.00 p.m.)

6. Organizational and institutional issues

While mastering new technology by itself represents a significant challenge, it is necessary to focus on issues such as organizational settings necessary to be put in place in order to take full advantage of these new approaches; what are the needs in terms of capacity building, such as education, training, skill development, and so forth; finally, costs and financial issues need to be addressed as well. These support issues are of great importance for the success of the census and its outputs.

Overview Paper:

Mexico (ESA/STAT/AC.115/20**): *Census Mapping with GIS: Institutional, Organizational and Financial Aspects***

A. The Secretariat of the Pacific Community (ESA/STAT/AC.115/22**)**
Mapping Census Infrastructure in the Pacific Islands: Institutional and Capacity Building Issues

B. Latvia (ESA/STAT/AC.115/23**)**
Supporting Institutional Development in Census Cartography: Lessons Learned from 2000 Census

Discussion

C. Australia (ESA/STAT/AC.115/24**)**
Capacity Building for Census Mapping Development: Highlighting Issues and Influencing Factors
Discussion

Lunch break (1.00 p.m. – 3:00 p.m.)

Afternoon session (3:00 p.m. – 6:00 p.m.)

7. Presentation by commercial developers of GIS

Currently there is a number of commercial companies that provide different services in the field of GIS and geo-coding. The Expert Group Meeting will invite the most commonly used technologies and software suites, such as ESRI, Intergraph, MapInfo, GeoSpace to present their experiences in the use of their products for census mapping, with a focus on evaluation of different software packages. The presentations followed by a question and answer session.

- GEOSPACE (ESA/STAT/AC.115/26**)**
- ESRI (ESA/STAT/AC.115/27**)**

Discussion

Friday, 1 June 2007

Morning session (10:00 a.m. - 1.00 p.m.)

8. Discussion and adoption of conclusions and recommendations

This Session focuses on the critical success factors for a GIS-based census mapping project, summarizes the findings of the Meeting and adopt conclusions and recommendations.