United Nations E/CONF.93/BP.4

Economic and Social Council

Distr.: Limited
14 December 2000

English only

Seventh United Nations Regional Cartographic Conference for the Americas
New York, 22-26 January 2001
Item 7 (b) of the provisional agenda*
Reports on achievements in surveying, mapping and charting in addressing national, subregional, regional and global issues, including technical issues

Mapping, geodetic control, remote sensing and Geographic Information Systems in the Americas and worldwide, 2000

Submitted by the Secretariat**

* E/CONF.93/1.

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00-80452 (E) 100101

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Abstract

The author has been requested by the United Nations to prepare a background paper for the 7th UN Regional Cartographic Conference for the Americas'with special emphasis on the Americas. Since no special survey by the UN for the year 2000 was performed (Distribution of a pertinent questionnaire to the National Cartographic Agencies of all UN – member countries), the available information is rather limited. Nevertheless, and in this background paper some comments are presented on the subject and dealing with the following aspects: Graphical and Digital Cartography (Digital Terrain Models) and geodetic control, the role of Remote Sensing Technology, for global/national mapping, relations between "National Cartography" and "Geomatics" and "Spatial Data Systems", future cartographic requirements, economics of cartographic operations. It is concluded that presently the world's and the continental cartography operations progress too slowly and consequently affect unfavorably the economy of larger development programs. For this reason it appears and must be recommended that steps be undertaken to increase the world's and local cartography operations, which might require to accelerate the world's annual cartography expenditures (budgets) from the present 0.1% of global GNP to an essentially higher percentage.

General Introduction

The United Nations perform 6-7 years periodic surveys on the status of world mapping. The results of these surveys are usually presented at the United Nations Regional Cartographic Conferences and are based on information received from questionnaires completed by the National Cartography Agencies of the UN-member countries. Consequently, it was the time for the UN to forward pertinent questionnaires to the National Cartographic Agencies which agencies would have returned completed questionnaires before the date of the present conference. However,this was not done due to lack or change of respective personnel at the UN although a number of cartography specialists had recommended to have presented at this conference the results of a pertinent survey for the year 2000 (Millenium survey). Therefore, many required data for the various UN member countries, year 2000, are unavailable. Nevertheless some incomplete, estimated or extrapolated data are presented in this background paper based on Sources 1) and 2). For this reason and because of missing data explains why the present background paper is essentially shorter than previous background papers.

I Status of the World's Graphical Topographical Mapping, Revision & Geodetic Control

1.Graphical Topographic Mapping and Revision (incl. Aeronautical Charting)

As in previous UN surveys the following scale ranges (categories) are considered (Ref. 1):

Range number	Category
I	1:25,000 and larger scales
II	1:50,000

III	1:100,000
IV	1:250,000

Because no UN survey data are available (completed questionnaires) for the year 2000 little information can be presented in the present background paper on progress rates of the 4 scale categories. The only approximate figure which can be given is for the category IV and the Americas: Category IV is practically completed or nearing completion (1:250,000 topo mapping for the Americas). The same applies for the status of map revision in this category.

Here some remarks must be made regarding the use of satellite imageries for topographic mapping. This concerns imageries from such satellites as, Landsat/Thematic Mapper, Radarsat, the american remote sensing satellite Ikonos etc. with image ground resolution of up to 1 m. Here the question arises to whether such imageries have appropriate inter-pretation possibilities. Prof. Petries from the U.K. reported on this problem (1996) and this by means of results obtained from the so-called "Africa Test". In this test certain satellite imageries were compared with imageries from SPOT and super-wide angle aerial photography cameras (MC and LFC). It was found that about 30% of the total required planimetric map features were not identifiable on most of the considered satellite images and would require expensive field completion for official topographic maps. By contrast, the percentage of required and identifiable planimetric features on the super-wide angle aerial photographies was much better, normally at the 90 to 95% level.

1) Background paper, by A.J. Brandenberger, United Nations Regional Cartographic Conference for Asia and the Pacific, Bejiing, May 9-18, 1994.
2) Laval University World Surveying & Mapping Data Bank, A.J. Brandenberger (Administrator), c/o Photogrammetry, Faculty of Forestry and Geomatics, Laval University, Quebec (Quebec), Canada G1K 7P4.

1. Geodetic Control

Topographic mapping requires the availability of a geodetic control network. At the present, it can be estimated that on the land area of the earth there are at least 4 million official horizontal geodetic control points and 4.5 million vertical control points, making densities of 1 point per 34 km^2 and 1 point per 30 km^2 .respectively. In many cases this geodetic control density is insufficient for larger scale topographic mapping and also for cadastral surveying and mapping, (S & M.).

Fortunately, this situation will be essentially improved by having now available new and much more efficient technologies such as the GPS (introduced by the U.S.A.) and a similar system, GLONASS, developed in Russia. Already now, GPS has become one of the most significant achievement in Geodetic Sciences with a major marketing potential for the GPS industry. This becomes evident even on the U.S. Government level (at a recent White House briefing, Vice President Al Gore stated that the US GPS is a technology developed by the U.S. Government that will explode the emerging GPS industry into an U.S. $ 8 billion industry within the next 4 years and will create 100,000 new high-tech jobs, primarily in California).

II Status of Digital Cartography (Digital Terrain Models)

Photogrammetry is the most important procedure for producing topographic maps. In the early past this was mostly done by graphical photogrammetry. At a later stage digital photogrammetry was introduced (analytical plotters, digital terrain models). But still and around 1995, Prof. Toni Schenk, President of a Commission of ISPRS, stated that probably less than 10% of all photogrammetry products were produced by digital photogrammetry. Consequently, the question arises about the usefullness of graphical maps (paper maps) and purely digital products. This becomes obvious from a

recent statement of Mrs. Vanessa Lawrence, Director General of the British Ordnance Survey: "There's a long-term future for paper maps – and the great success of the new Explorer series demonstrates that there,s a real demand for them. People who try to write them off are the same people who are convinced that books are going to disappear because information can be downloaded into palm-top computers. I don't believe it".

By the way, and as far as digital Terrain Model Technology is concerned it should be noticed that by the presently used and rather primitive point by point methods (Raster and Vector Systems) only form lines can be produced which are of lower accuracy when compared with lines stereophotogrammetrically plotted (e.g. contour lines) and in most cases the resulting maps would not reach an accuracy satisfying the rather stringent accuracy specifications for official topographic mapping.

III Use of Remote Sensing Technologies for Global and Regional Map Coverages

It is known that photogrammetry and remote sensing technology and professions are closely related because both use aerial photographs or satellite imageries. Because of this, and in many countries, the pertinent professional societies are called National Societies of Photogrammetry and Remote Sensing. Nevertheless there are some differences between both professions in as much as photogrammetrists have some fairly good experience in photointerpretation and remote sensing while remote sensing specialists in general do not have enough professional experience in photogrammetry and geodetic sciences (ex. cadastral surveying & mapping which requires good legal experience). On the other hand remote sensing technology developed very rapidly in recent years and the respective world market is estimated at US $15 billion. For this reason some agressive remote sensing specialists attempt to dominate the photogrammetrists. An examply is the U. K. where the Photogrammetry Society has been merged with the Remote Sensing Society and it was proposed that the merged ociety should be named "The Remote Sensing and Photogrammetric Society". This is wrong, because photogrammety still belongs to geodetic sciences, and also in view of the

fact that national geodetic control and national mapping are the responsibility of governmental and pertinent government departments.

IV Relation between National Cartography and Geomatics (Geographic Information and Spatial Data Systems)

It is the responsibility of National and Local Governments to reach for each country or territory a cultural and economic level as high as possible. This also applies to National Cartography (incl. National Geodesy). Further, economic and technical assistance programs to development countries must be considered and this also in view of the increasing internationalization of economic and technical development operations. This means that world -and national information policy and technology play an increasingly important role. This was the reason for the creation of the term "Geomatics", which is of a wider range than the classic term "Surveying and Mapping", and includes "Geographic Information Systems, GIS", or "Spatial Data Systems".

V Future Cartography Requirements

In the future cartography operations worldwide must be accelerated, and this for the following reasons (factors): for the first time the worlds urban population has reached the percentage of 50% of the world population, and also because of a boom in the world's Tourism Industry (According to OECD Tourism has become the biggest industry in the world. It offers jobs for 200 million people and contributes 11.7% to the global GNP. Almost 700 million tourist arrivals were expected for the year 2000 , and this number is estimated to grow to 15 billion by the year 2020). Consequently, both factors will require substantial acceleration of world, regional and national cartography operations and this particularly for the larger scales surveying and mapping sector.

VI Economics of Cartographic Operations, [Surveying & Mapping (S & M)] Activity

The present world's "Surveying & Mapping Activity" is an operation which involves a manpower of approximately 1.9 million persons with annual expenditures in

the order of US $ 25 billion (approximately 0,1% of the world's GNP). The particularity of this operation is that it is in many cases the first phase of larger development programs or projets. Consequently a too slow S & M phase could cause program termination delays which capitalised could exceed in a short time the cost for the entire S & M phase. Indeed, it must be stated that in the past and presently the world's S & M phase is too slow and steps have to be undertaken to accelerate this operation. This not only applies to S & M in general but also in view of special requirements for the forestry industry (the world's forest cover still amounts to nearly 30% of the world's land area) and also in view of the world's energy crisis (energy industry; the proofen oil reserves presently amount to 1,030 billion barels, but the global annual oil consumption increased by 32%). Also the world's Hydrographic S & M operation must be accelerated with regards to the transport industry on the water and the fishery industry (the world's fishery production is worth more than US $ 83 billion per year). Here, Cadastral S & M plays a particular role, also in the Americas: in Latine-American countries properties are not protected by property rights, (properties make up 90% of family assets in rural areas and 50% in urban areas; in the U.S.A. the percentage is 40%). In these areas, cadastral S & M costs substantially less than 1% of the property value (a more precise percentage still remains to be determined).

VII Conclusions and Recommendations

Starting a new Millenium, a number of cartographers have suggested that a survey of the status of world cartography be again made for the year 2000 or eventually the year 2001 and this by the United Nations. Unfortunately such a survey has not yet been done.

For this reason it is highly recommended that such a survey be done as soon as possible and that the United Nations forward a pertinent questionnaire on the status of national mapping to the chiefs of all National Cartography Agencies whose countries are member states of the United Nations.