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FROM SURVEYING AND MAPPING TO GEOMATICS CHALENGES AND OPPORTUNITIES

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In one generation, we have progressed from computations by logarithmic tables and hand calculators to powerful electronic computers, from measuring tapes to electronic distance measuring devices such as Tellurometer, Shoran, Aerodist and to Global Positioning System (GPS), from aerial photography to satellite imagery, digital airborne cameras, Inferometric Synthetic Aparture Radar (IFSAR) and LIDAR, from analog to digital photogrammetry and digital image analysis, from traditional paper maps to digital mapping and Geospatial Information Systems – in short from surveying and mapping to Geomatics.

What is Geomatics? Geomatics is the science and technology dealing with the acquisition, management, analysis and modeling of spatially referenced data and the creation and maintenance of Geospatial Information Systems.

Geomatics encompasses a broad range of disciplines: geodesy, photogrammetry, cartography, remote sensing, hydrography, geographic information systems (GIS), global positioning systems (GPS) and computer science.

The term Geomatics was coined in early 70's by Dr. Bernard Dubuisson, a French ingenieur geographe, who at that time was visiting professor of photogrammetry at Laval University in Quebec City. It was quickly adopted in Canada as this term is identical in both official languages, English and French. Many other countries adopted the term Geomatics, other prefer to use Geospatial Information Science. At many universities, departments of surveying engineering changed to geomatics engineering. Some government departments also adopted the term Geomatics. In Canada the Surveys and Mapping Branch and the Canadian Center for Remote Sensing are now part of a new organization Geomatics Canada. In the USA, the old Army Map Service is now the National Geospatial Intelligence Agency.

Since the beginning of civilization, the map has been the most useful and effective means of portraying geographical information. It was a sort of "Databank of Geographical Information" in graphical form. To-day, in the digital era and the rapidly advancing information society, it is replaced by digital Geospatial Databases and Geospatial Data Infrastructure. A map is, but one of many visualization options of portraying geospatial data. Visualization of geospatial data can be interactive or in the form of still imagery and animation.

Initially, the efforts directed at the development of digital mapping were stimulated by the desire to automate the production of traditional paper maps in order to produce maps "untouched by the human hands". The digitized terrain data were looked upon as a by-product of the computer assisted map production process, and very little attention was paid at first to the value of digital topographic data for use other than automated drafting. This has however soon changed. To-day digital data are of prime importance and are recognized as the foundation of a Geospatial Information System. Maps are important, but are only one of many visualization products of geospatial data.

The depiction of terrain features in the graphic and digital environments is quite different in nature. In the graphic environment one is constrained by the notion of the scale of a map, i.e. the number of features one is able to display on a piece of paper, hence the requirement for generalization of content and displacement of features. In the digital environment, these constraints do not exist. Digital data do not have a "scale". Each terrain feature is expressed by points, strings of points, arcs or lines, in terms of X,Y,Z, coordinates. The digital Database is capable of containing a practically unlimited number of terrain features, in their true geographic location, regardless of how close they are to each other on the earth surface and without the need for generalization.

Availability of digital map data created the desire of using computers to ask questions of digital maps, to be able to read them, to measure, combine, compare and analyze data that they contained and to model different phenomena. This led to the concept of Geographical Information System (GIS) which was conceived and developed by the Canadian geographer Dr. Roger Tomlinson in early 1960's. He is widely regarded as the "father of GIS".

The rapidly expanding range of information technology applications that relay on geographic location call for establishment of an environment that would enable integration, to a common standard, of disparate geospatial data provide seamless views and to enable universal access to and the sharing of any kind of geographic information. That environment is provided by a Geospatial Data Infrastructure.

It behoves the national governments to provide the necessary administrative structure and financial resources for a National Geospatial Data Infrastructure (NGDI). To be successful NGDI must be build on the principle of partnership and co-operative effort between all levels of government and the private sector, all working collectively towards a national infrastructure for access to geospatial information. This is not a simple task. The problems that are encountered are not technical, but administrative. It is in the domain of the geomatics engineers to establish, maintain and manage the Geospatial Data Infrastructure. This opens new and challenging opportunities for geomatics engineers. At the same time their education must reflect the changing role this profession should play in to-day's information society. To meet this challenge, the University of New Brunswick , in the fall of 1997, started to offer, for the first time, a concurrent degree program in computer science and geomatics engineering. This program is intended to provide an in-dept computer programming and data base management education with an understanding of positioning, mapping, geographic information system engineering and spatial analysis.

In Canada as well as in the USA we are experiencing an increased interest in Geomatics – Several Universities and Colleges have formed Geomatics departments not only in the traditional surveying engineering and engineering faculties, but in the faculties of geography, environmental sciences or computer science. Some offer Masters' degrees in GIS, others Diplomas in GIS. This development is a direct result of the growing application of Geographic Information System (GIS) in support of decision making processes in areas such as transportation, town planning, municipal management, energy, environmental protection, natural resources management, public health, marketing and many others.

Not so long ago, surveying and mapping was the almost exclusive domain of survey engineers. To-day Geomatics is embraced by many other professions. For example, GIS is dominated for the most part by geographers, environmental scientists and others who are concerned with phenomena which have a geographic location.

The technology at our disposal to-day changed profoundly the domain which belonged to geomatics engineers. Not so long ago, it required the skills of a geomatics engineer to establish geographic position or to compile maps. To-day everyone is capable of establishing geographic position using GPS or producing a street map by driving every street with an GPS. He can then place this street map on the Web for everyone to use. Making use of the Internet, anyone is capable to download, free of charge, satellite or airborne imagery from Google Earth or the recently launched high resolution satellite GeoEye-1, which offers stereo capability, and with a proper software, compile his own map. This amateur geospatial information can be made available on the Web. This "volunteered geospatial information" (VGI) is now visible across the Web supporting collaborative social networking applications such as Open Street Map, GeoCommons and others. VGI and its implementation presents a wide range of opportunities as well as many risks which must be considered by public as well as private geomatics organizations word-wide. This emerging trend offers the opportunity to employ VGI's for updating geospatial databases. However, the notion of employing contributions even from trained amateurs evokes some uneasiness about the risks involved.

The computer, information technology, digital mapping, GPS, satellite imagery and the Internet have unleashed profound changes in the way geospatial information is acquired, managed and used.

The changes we are witnessing are, in my view, as significant as those resulting from the invention of the printing press. The printing press made possible to spread literacy to the masses. Geomatics and the Internet is making up-to-date geospatial information instantly accessible to the masses, permit correlation of a multitude of information and creation of new knowledge by individual members of the information society of the 21st century.

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