

The Reason of Changing The Name to “Geomatics”

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Key words: Geomatic Engineering Program, Curriculum Design, Sectoral Analysis

SUMMARY

Terrestrial surveys with a much older history have been the fundamentals for determining size and shape of the earth, and of establishing country and continent wide reference Networks. Ancient time, the surveyors were called as a person who uses geometry and primitive tools such as surveying rope in order to define the Cadastral edge. A lot of words have been used in order to express Geomatic Engineering from Ancient time to today such as Geometrist, Surveyor, Survey Engineer, Geodesist, Photogrammetrist, Cartographer, Geoinformatiker, Geomatician etc. As the parallel to the technological development, surveying and mapping sector has improved itself and adapted to the new phenomena. Last two century, the most affected engineering due to the revolution in computer and space technology may be Geomatics all over the world.

From early 1900, the profession of surveying and mapping, Geodesy and Photogrammetry Engineering (GPE) has been evaluating according to technological, social and educational developments in Turkey. Nowadays, GPE has to be re-constructed cause of following the global constrains. The new system must contain the GIS, geoscience and computer science beside of geodesy, cartography and surveying including photogrammetry, remote sensing, and satellite systems. The new trend for GPE is Geomatics Engineering and the process for converting GPE to Geomatics has already been starting in Turkey. In this study, the recent situation of GPE in Turkey about process of transformation to Geomatics is presented.

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1. INTRODUCTION

From early 1900 to nowadays, traditional Surveying Engineering profession has been evaluating according to technological, social and educational developments in Turkey. The first professional applications were started at 19th century at a time of Ottoman Imperial in order to being carried out to cadastre. After the Republic of Turkey was founded, the land surveying for cadastre, urbanization and mapping has gotten increase in Turkey. The first professionals were graduated in Europe and came back to offer an education to officers in the military institutes. At the other hand, the civil surveying education was associated in universities under the Civil Engineering as a part of division with the name of ‘Topography’.

The names of the surveying and mapping departments has changed at least four times from ”topography” to ”geomatics” in Turkey. The first department was established at Yildiz Technical University (YTU) as being ‘Mapping and Cadastre Engineering’ in 1949. After that, Karadeniz Technical University (KTU) and Istanbul Technical University (ITU) were started to graduate with the name ‘Geodesy and Photogrammetry Engineering’. Nowadays, there are eight universities with 4-year degree programs. Furthermore, within the technical schools, there are 20 universities offering 2-year surveying programs for technicians with the names ‘Mapping and Cadastre’ and ‘Geodesy and Photogrammetry’.

As being parallel to the technological developments, especially after the Second World War II, the content of the surveying and geodesy were restructured. Because the labor market was updated itself from terrestrial surveying to space based and industrial surveying and Geographic Information Systems, etc. The names ‘Geomatics’ and ‘Geoinformatics’ were used to being called new phenomena (Yavasoglu et al. 2009).

ITU Geodesy and Photogrammetry Engineering (ITU-GPE) Department is monitoring the technological and scientific developments in the international domain and is aware of this new paradigm. ITU-GPE is revised his curriculum in 1997. This new program has been accredited by ABET (Accreditation Board for Engineering and Technology) in 2006 for 6 years. ITU-GPE Department carries out a reconstruction project defined in his 2006-2009 official strategic plan. A requirement matrix was produced by the use of the quality measures and feedbacks. Furthermore, a sectoral analysis survey is organized and realized nationally. The survey results have been orientated the project. In 2009, the Department has changed his name from ‘geodesy & photogrammetry engineering’ to ‘geomatics engineering’ after the approval of the Higher Education Council of Turkey (YOK). In this study, it is aimed to present the road map and the work flow by explaining the details of the reason why the department has changed his name.

2. GEOMATIC ENGINEERING

2.1 “Geomatics”, A new Paradigm

Geomatics comes from the French word “*géomatique*”. Its roots are “geo” (Earth) and “informatics” (information + automation + “ics” which is the accepted form for the name of sciences). Another description of Geomatics was derived from two words **Geodesy+Geoinformatics**. In the Latin language, the Geomatics correspond to Geomatica (Ipbuker, 2008, Kemp, 2007, Yavasoglu et al. 2009). The Geomatics was defined in the Oxford Dictionary as a new phenomena as follows;

“Geomatics: The mathematics of the earth; the science of the collection, analysis, and interpretation of data, especially instrumental data, relating to the earth's surface” .

Geomatic Engineering is a modern discipline, which integrates acquisition, modeling, analysis, and management of spatially referenced data, i.e. data identified according to their locations. Based on the scientific framework of geodesy, it uses terrestrial, marine, airborne, and satellite-based sensors to acquire spatial and other data. It includes the process of transforming spatially referenced data from different sources into common information systems with well-defined accuracy characteristics (URL-1). Beside of these, the Geomatics involves intersection of the Physical, Biological, Business and Social sciences with respect to mathematical and logical relationships as illuminated Fig 1 (URL-2).

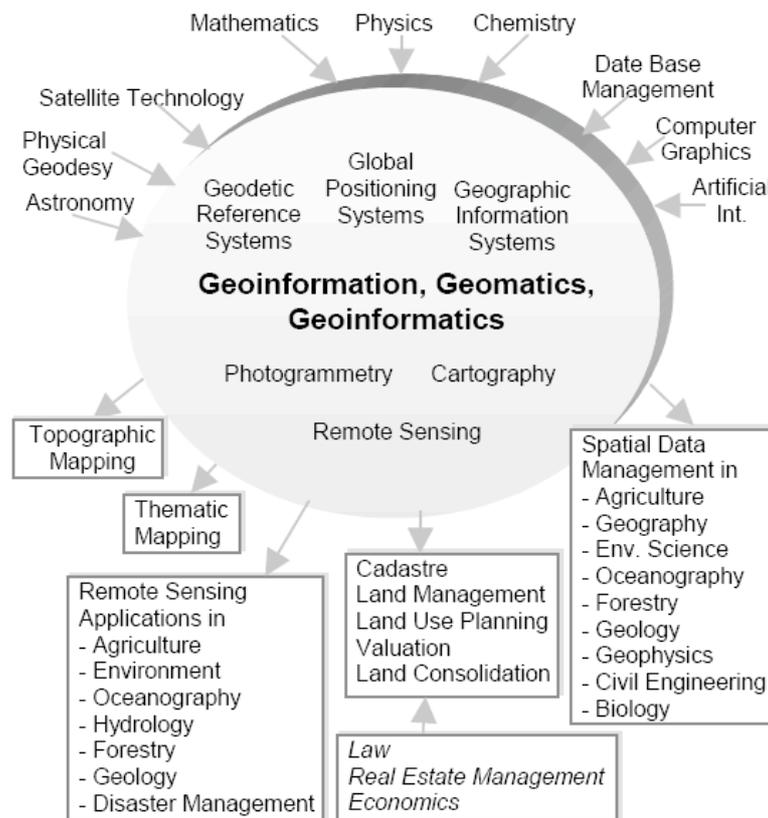


Figure 1. Geomatics (After Konecny, 2002)

The first documented appearance of this term goes back to the early 1970s in France, at the Ministry of Equipment & Housing (cf. *Commission Permanente de la Géomatique*). At that time, it simply referred to the automatic processing of geographic data. At the same epoch, the word "photogéomatique" was also coined specifically for the automatic processing of data obtained from aerial photographs. However, these two words and their narrow definitions never achieved widespread attention and stopped being used (Kemp, 2007, Yavasoglu et al. 2009).

A few years later, the term "*géomatique*" was reinvented in Canada, to convey the modern view that was becoming common amongst the disciplines involved in data acquisition, processing and dissemination of spatial data (i.e. surveying, photogrammetry, geodesy, hydrography, remote sensing, cartography and GIS). It was created as an umbrella term encompassing every method and tool from data acquisition to distribution. Without knowing about the earlier, narrower use of this term, it was Michel Paradis, a photogrammetrist working for the Ministry of Natural Resources in the Quebec Provincial Government, who created this word especially for his keynote paper at the 100th anniversary symposium of the Canadian Institute of Surveying (which became the Canadian Institute of Geomatics). It was Laval University Surveying Department, in 1986, developed the first academic program in geomatics in the world in replacement of its Surveying program and the name of the Department and of the Faculty. Nowadays, it is widely recognized that Michel Paradis is the father modern geomatics paradigm of the while its mother is Laval University (Kemp, 2007, Yavasoglu e al. 2009).

2.2 “Geomatics” in Engineering Education

Geomatics and Geoinformatics terms were used to being called new phenomena. The North American academic and private sector have strongly embraced Geomatics. The some of European colleagues have been preferred Geoinformatics. Beside of these, both of them have been used at Australian and South African community (Ipbuker, 2008, Yavasoglu et al. 2009). The some of the Universities which have department of Geomatics have given on Table 1.

Table 1. Some of The Universities which has Geomatic Departments (Yavasoglu et al 2009)

University	Country
<i>University of Melbourne Australia Dept. of Geomatics</i>	<i>Australia</i>
<i>University of New South Wales School of Geomatic Eng.</i>	<i>Australia</i>
<i>TU Delft MSC Geomatics Programme</i>	<i>Belgium</i>
<i>Universite de Liege Dept. de Geomatique</i>	<i>Belgium</i>
<i>Universidade Federal do Parana Depto. de Geomatica</i>	<i>Brasilia</i>
<i>Rio de Jenairo State University Department of Geomatics</i>	<i>Brasilia</i>
<i>University of Calgary Dept. of Geomatics Engineering</i>	<i>Canada</i>
<i>Univ. of New Brunswick Geodesy and Geomatics Eng.</i>	<i>Canada</i>
<i>Ryerson University Geomatics Engineering</i>	<i>Canada</i>
<i>Wuhan University School of Geodesy and Geomatics</i>	<i>China</i>
<i>Univ. del Valle Escuela de Ingenieria Civil y Geomatica</i>	<i>Colombia</i>
<i>University of Zagreb Institute of Geomatics</i>	<i>Croatia</i>
<i>UCL Department of Geomatic Engineering</i>	<i>England</i>
<i>University of NewCastle upon Tyne Dept. of Geomatics</i>	<i>England</i>
<i>Humboldt Universitaet Geomatik</i>	<i>Germany</i>
<i>Hochschule Karlsruhe Tech. und Wirt. Dept.of Geomatics</i>	<i>Germany</i>

<i>Politecnico di Milano Laboratorio di Geomatica</i>	<i>Italy</i>
<i>Technical University of Latvia Dept. of Geomatics</i>	<i>Lithuania</i>
<i>University Teknologi Malaysia Department of Geomatics</i>	<i>Malaysia</i>
<i>Universidad de Colima Ingeniero Topografia Geomatica</i>	<i>Mexico</i>
<i>University of Science and Technology Div. of Geomatics</i>	<i>Norway</i>
<i>Gjøvik University College Geomatics</i>	<i>Norway</i>
<i>University of Cape Town Dept. of Geomatics</i>	<i>South Africa</i>
<i>University Gävle Sandviken Div. of Geomatics</i>	<i>Sweden</i>
<i>ETH Zurich Dept. of Civil, Env. and Geomatic Engineering</i>	<i>Switzerland</i>
<i>Universidad de la Republica Depto. de Geomatica</i>	<i>Uruguay</i>
<i>University of Alaska Department of Geomatics</i>	<i>USA</i>
<i>University of Florida Department of Geomatics</i>	<i>USA</i>
<i>California State University (Fresno) Dept. of Geomatics</i>	<i>USA</i>
<i>Purdue University Geomatics</i>	<i>USA</i>
<i>Red River College Geomatics Technology</i>	<i>USA</i>

3. GEOMATIC ENGINEERING IN TURKEY

In Turkey, there are eight universities with 4-year degree programs offering surveying and mapping engineering education with BSc, MSc, and PhD degrees. An additional three universities intend to begin offering surveying engineering education. Within the technical schools, there are 20 universities offering 2-year degree programs for mapping technicians within approximately 40 departments in different regions of Turkey. Furthermore, surveying engineering education has been offered to officers in the military college in the General Command of Mapping since 1969. The master's degree programs are designed to be completed in 1.5 or 2 years and consist of both compulsory and elective courses, some offered in English. Members of the educational staff have official authority to conduct a course, and the average distribution of staff in the universities belonging to the main science divisions is shown in Figure 2 (Coskun, 2007).

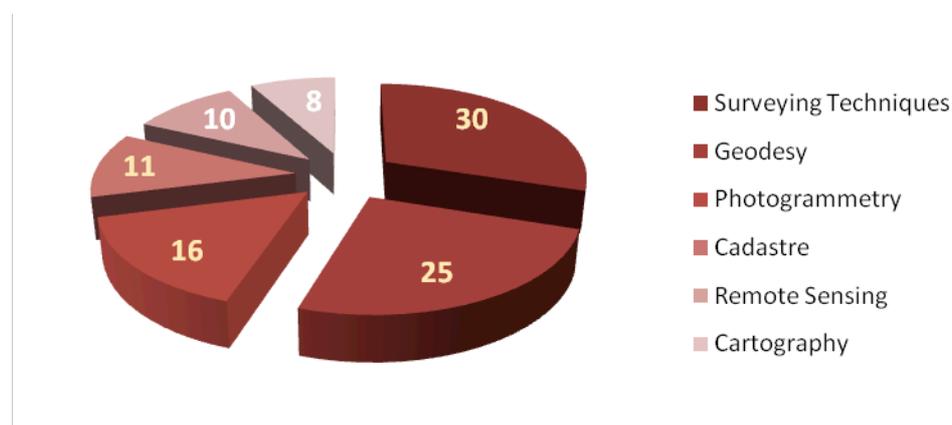


Figure 2. Distribution of Staff belonging to the Main Science Divisions in Faculties

4. GEOMATIC ENGINEERING IN ITU

The Geomatic Engineering Department of Istanbul Technical University (ITU-GE) graduate engineers to the sector for surveying and mapping. Satellite remote sensing, GPS, GIS and related technologies change the vision and mission of the sector and convert the traditional

surveying and mapping discipline into a new form under the name of ‘geomatics’. Under this assumption, there occurred a requirement for a re-configuration of the previous geodesy and photogrammetry engineering program and curriculum. This process is conducted under an official project which is maintained by a departmental commission due to the annual strategical plan of the department in 2006. ITU-GE Department revised the undergraduate program by decreasing the total number of credits from 180 to 153 with a requirement that 30% of the credits must come from the courses taught in English. The driving force of this drastic change is referred to the goal of Istanbul Technical University to implement a continuous quality assurance system in the way of an international accreditation. This new curriculum has been accredited by ABET (Accreditation Board for Engineering and Technology) in 2006 for 6 years (Ipbuker et al 2009).

A curriculum committee has established and the committee evaluated the prerequisites of departmental courses and asked faculty to recommend a change or to propose new technical elective courses in the curriculum. The other major changes in the curriculum were to introduce more engineering design experience in addition to offering the general education courses necessary to identify the impact of engineering decisions in a broader societal context. The courses are classified and collected under different types like basic science (BS), basic engineering (BE), science of human and society (SHS) and profession and engineering. Program also involves 8 restricted elective course packages related different fields (Table-3). Students have to elect one of the courses from each package. The main properties of the Geomatic Engineering curriculum are summarized on the following tables and the percentage of fields are presented in Figure-1 (Ipbuker et al 2009).

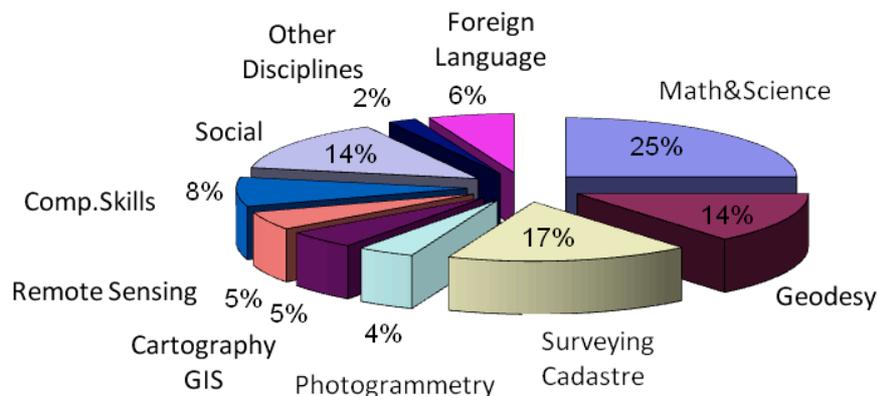


Figure-1: Percentage of fields in the ITU-GE program

The project has aimed to analyze the sector in its global setting and also to determine the implications of current and future market and technology changes for the human resources in the sector. In this context, a public survey questionnaire is prepared and applied to the broad agreement of the industry, several departments of government and universities. Collected data are evaluated; tables and profiles have been developed that characterize the current and forecasted situation. The results are combined and presented in a study report. Together with an analysis of the science and technology, market and business changes influencing the sector,

the report constitutes a basis for effective planning on the curriculum of a Geomatic Engineering program (Ipbuker et al. 2009).

The survey results will orientate the work for the reconstruction of the geodesy and photogrammetry engineering program to geomatics. The results also cleared and clarified the professional components of a geomatic engineering curricula. Geomatics, composed of the disciplines of geopositioning, mapping and the management of spatially oriented data by means of computers, has recently evolved as a new discipline from the integration of surveys and mapping (geodetic engineering) curricula, merged with the subjects of remote sensing and geographic information systems.

The generic and the field skills for a geomatics education may be summarized as recommended and published in the human resources study of Canadian Council of Land Surveyors, Canadian Institute of Geomatics and Geomatics Industry Association of Canada (Table-3 and Table-4) (URL-3). The ITU-GE Department’s sectoral analysis report verifies the Canadian experiences (Ipbuker et al. 2009).

Table-3:Generic Skills for Geomatics

Generic Skills for Geomatics	
Business Skills	Technical Skills
<ul style="list-style-type: none"> • Financial statement analysis • Contract negotiation • Proposal, report and science paper writing • Marketing • The ability to secure funding • Leadership and management skills • Team skills • Presentation skills • Project management skills 	<ul style="list-style-type: none"> • Geodesy • Cartography • Photogrammetry and Remote Sensing • Geographic Information Systems (GIS) • Global Positioning Systems (GPS) • Computer Aided Drafting systems (CAD) • Computer hardware and software • Data visualization and interpretation • Data formats and transfer

5. CONCLUSION

From early 1980 to nowadays, the education on surveying and mapping has become a one of the popular engineering in Turkey. On the contrary, the development in geosciences and national requirements has forced to surveying departments to transform themselves to Geomatics. As the parallel to the technological development, surveying and mapping sector has improved itself and adapted to this new phenomena. Last two century, maybe the most affected engineering from revolution of computer and space technology is Geomatics all over the world. That’s the reason, why the Department of Geodesy and Photogrammetry Engineering at ITU has changed his name to “Geomatics”.

The experience of ITU-GE Department offers an “unofficial” consultancy to other Geodesy and Photogrammetric Engineering departments of several other universities in Turkey. The progress achieved in the ITU-GE Department by the use of quality measures and feedback taken from them has captured attention of other fellow departments in other universities. ITU-GE Department is monitoring the technological developments in the international sector and considering them in its program improvement efforts.

Table-4: Field Skills for Geomatics

Field Skills for Geomatics		
Surveying	Cartography	Remote Sensing
<ul style="list-style-type: none"> • Survey law • Legal surveys procedures • Traditional survey equipment • Computerized land information systems • Global Positioning Systems (GPS) • Geographic Information Systems (GIS) • Computer Aided Drafting systems (CAD) • Computer hardware and software • Construction surveying • Pre-engineering surveying • Property rights systems • Land planning and management • Understanding/interpretation of data 	<ul style="list-style-type: none"> • Specialized equipment viz. stereo plotters, • airborne survey cameras, sensors and scanners • Computer graphic systems • Image processing software • Image interpretation • Geographic Information Systems (GIS) • Computer Aided Design systems (CAD) • Desktop publishing • Computer hardware and software • File management: meta data and file transfer 	<ul style="list-style-type: none"> • Hyperspectral/ultraspectral/radar /lidar techniques • Algorithm development • Spectral data exploitation • Specialized equipment • Large volume data mining • Data visualization • Data format conversion and GIS/RS integration • Field campaign design and implementation • In situ remote sensing validation techniques • GIS/RS integration • Analytical principles and procedures • Electromagnetic spectrum • Image acquisition, processing and interpretation
Geographic Information Systems (GIS)		Navigation and Positioning
<ul style="list-style-type: none"> • Principles of Geodesy • Control survey networks • Spatial referencing systems and positioning • Computer Aided drafting systems (CAD) • Engineering surveying • Coordinate geometry • Photogrammetry • Computer hardware and software – external databases • Surveying, earth observation and cartography • Database/information structures, algorithms, design and systems • Geospatial data analysis, modeling and display • Spatial statistics 		<ul style="list-style-type: none"> • Electronic navigation systems for positioning, navigating, guiding and controlling air, land, and sea vehicles • Custom software to integrate hardware systems • User interfaces for navigation and guidance systems • Position-related information organized in databases • Use of integrated inertial measurement units and GPS • Understanding of ellipsoids, datums, map projections • Application of navigation and positioning into other geomatics areas • Geometrical geodesy

ACKNOWLEDGEMENT

Thanks are going to all my colleagues at ITU-GE Department, especially to my partners in the Education and Improvement Committee and to Prof. Dr. Rasim Deniz, the head of the committee, who are the engine of the study.

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BIOGRAPHICAL NOTES

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Cengizhan Ipbuker is a professor at Istanbul Technical University Department of Geomatics. He was born on 1959 in Istanbul. He is a surveyor and cartographer for more than 20 years professional experience and holds all of his degrees from the Istanbul Technical University. Professor Ipbuker has published several articles in English and Turkish in different scientific Journals and participated in several national research projects on GIS. He is also an author of a turkish lecture book on mathematical cartography and map projections. He is a member of the Chamber of Turkish Survey and Cadastre Engineers. He is married with two children.

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