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HELLENIC REPUBLIC  
**H.Q.A.**  
 HELLENIC QUALITY ASSURANCE AND  
 ACCREDITATION AGENCY

## EXTERNAL EVALUATION REPORT

School of Rural and Surveying Engineering  
 Faculty of Engineering  
 Aristotle University of Thessaloniki

February 2014



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## External Evaluation Committee

The Committee responsible for the External Evaluation of the School of Rural and Surveying Engineering in the Faculty of Engineering of the Aristotle University of Thessaloniki consisted of the following five (5) expert evaluators drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005:

1. Dr. Harilaos Koutsopoulos (Coordinator)  
Division of Traffic and Logistics, KTH Royal Institute of Technology, Sweden
2. Dr. Michael G. Sideris  
Department of Geomatics Engineering, University of Calgary, Canada
3. Dr. Ericcos C. Pavlis  
Goddard Earth Science and Technology Center, University of Maryland, Baltimore County, USA
4. Dr. Georgia Fotopoulos  
Department of Geological Sciences and Geological Engineering, Queen's University, Canada
5. Dr. Sotira Yiacoumi  
School of Civil and Environmental Engineering, Georgia Institute of Technology, USA

***N.B.*** The structure of the “Template” proposed for the External Evaluation Report mirrors the requirements of Law 3374/2005 and corresponds overall to the structure of the Internal Evaluation Report submitted by the School.

*The length of text in each box is free. Questions included in each box are not exclusive nor should they always be answered separately; they are meant to provide a general outline of matters that should be addressed by the Committee when formulating its comments.*

## ***Introduction***

### ***I. The External Evaluation Procedure***

The committee conducted an on-site visit to the School of Rural and Surveying Engineering in the Faculty of Engineering of the Aristotle University of Thessaloniki from November 18 to November 20, 2013.

The committee met with constituents of the University and several members of the School including:

- the Vice Rector of the University,
- the Dean of the Faculty of Engineering,
- the Chair of the School,
- faculty members of the School,
- postgraduate students of the School,
- graduates of the School,
- administrative staff of the School,
- laboratory and research staff of the School, and
- staff of the Research Committee (ΕΠΙΤΡΟΠΗ ΕΡΕΥΝΩΝ) of the University.

The undergraduate students, although invited, through their union representatives refused to participate in meetings with the committee. They only expressed their disapproval of the process at the beginning of the meeting on Nov. 19.

The meetings, especially during the first day, were particularly difficult as faculty and staff were impacted by the release of the list of personnel that were released from their duties due to budget cuts.

Prior to the on-site visit, the committee received several electronic documents about the School, including the Internal Evaluation Report for 2012-13, the Undergraduate Studies Handbook for 2013-14, the Annual Report for 2012-13, and the Graduate Studies Handbook. The website of the School is also well organized and contains a lot of useful information, material, course evaluations, and other pertinent context.

The majority of the faculty members of the School gave presentations during the on-site visit about the curriculum as well as their teaching and research activities, and those presentations were provided as electronic copies to the committee. The committee visited several academic facilities, including the classrooms, research and computer laboratories, faculty offices, the library of the School, as well as the newly created library of the Faculty of Engineering. The committee also visited the University's Seismological Station where some faculty members of the School have major research equipment, such as the state-of-the-art Micro-g LaCoste A10 absolute gravimeter.

### ***II. The Internal Evaluation Procedure***

The committee had access to two internal evaluation reports with the latest conducted for the academic year 2012-13 and dated November 2013. This internal evaluation report is very comprehensive and includes valuable data and information for the School. The report was based on a variety of sources and data related to the curriculum, teaching, research, and collaboration with social, cultural, and production organizations. It is the impression of the committee that the School used all the information available to them to complete this report.

Based on the information gathered and its analysis, conclusions were reached and plans for

improvement were provided. As similar issues are faced by other Schools of the Faculty of Engineering, the findings of this internal evaluation report may also complement the reports prepared by the other Schools. In this respect, the report has met the objectives of the internal evaluation process. One criticism is the lack of strategic planning for the School, which is a reflection of the lack of strategic planning for the University as a whole. As the strategic planning for the University is being developed, it will be easier for the School to develop its own. In addition, several of the plans of improvement in the report, though justifiable, are beyond the control of the School as they depend on new funding from the University and the government.

## **A. Curriculum**

### **A1: UNDERGRADUATE PROGRAM**

#### **APPROACH**

The curriculum was designed to provide a well balanced profile of Rural and Surveying Engineering starting from a fundamental understanding of the geometry of the Earth's surface and associated mapping processes used to plan, organize and perform development projects. Overall, the goals of the curriculum are to provide a solid theoretical background and technical skills in three scientific areas represented by the three Departments:

- (a) Geodesy and Surveying (GS)
- (b) Cadastre, Photogrammetry and Cartography (CPC)
- (c) Transportation and Hydraulic Works (THW)

The aforementioned topics are compliant with the professional areas designated by the Technical Chamber of Greece for Rural and Surveying Engineers. The first Department, GS, offers the fundamental knowledge of the Earth's geometry, CPC offers the "materials" for embedding the frame within a mapping continuum, and THW offers the tools for development works within the Earth's geometric continuum. The curriculum consists of 10 semesters and 56 course equivalents, of which 44 are core and 12 are elective. The first 6 semesters are common core amongst all students. The next two semesters orient the students to topics covered by each of the Departments, namely geodesy and surveying, cadaster, photogrammetry and cartography, transportation and hydraulic works. The last (10<sup>th</sup>) semester is dedicated to the Diploma thesis, which is linked to some additional courses from seven distinct topics, namely, geodesy, surveying, cadastre and GIS, photogrammetry and remote sensing, cartography and geography, transportation engineering, and hydraulic engineering. Students select their Diploma thesis topic in the 8<sup>th</sup> semester of their studies. The curriculum is designed so that a student who does not have any interruptions and takes the full course load each term can complete the program in 5 years.

As the field of Rural and Surveying Engineering is constantly evolving with the introduction of new technologies and techniques for measuring and mapping the Earth and its agglomerates, the curriculum objectives and courses are periodically assessed in order to ensure that the technical skills and background acquired by the students during their studies is current. This involves current methodologies, technologies and available data sources. In a future curriculum redesign, the School may consider whether the current structure is the best way forward in light of opportunities and technological developments.

In terms of courses (in number and content), the program is very rigorous offering a deep theoretical background in a wide array of topics. This is also combined with technical skills associated with operating surveying equipment (from theodolites to GPS receivers) offered through field-based laboratories and courses primarily in the first years of studies.

The curriculum and its changes are determined by a curriculum committee consisting of representatives from each Department (GS, CPC, THW), including professors and undergraduate students. Other constituents that could be considered in the preparatory phase of major revision/restructuring of the curriculum include (a) former undergraduate students, (b) graduate students, (c) members of industry, (d) members of other universities (either within Europe or international), and (e) members of relevant research organisations and/or government agencies. Part of the curriculum committee's role is to monitor the implementation of the curriculum. In the past, the committee was also responsible for:

- a) merging elective courses where similar topics were covered, and
- b) introducing new courses.

The frequency of the curriculum committee's meetings is unknown, but should be at least

once per annum.

### **IMPLEMENTATION**

Currently, the School offers a very rigorous course curriculum in each Department beyond the 44 core courses through a series of 67 technical electives. There is also a built-in mechanism to provide students with an elective internship in their 7<sup>th</sup> semester. All undergraduate courses have been assigned credits in accordance with the European Credit Transfer System (ECTS) to facilitate student visits/exchanges to other countries within the European Union. Given the School's goal of offering a solid theoretical background as well as technical skills, the School exceeds expectations.

Compared with similar university programs within Europe and worldwide, the School offers more courses at a high level. In North America, a typical undergraduate engineering degree consists of 40 courses. A thesis-based Master's degree consists of 5 graduate level courses and a course-based Master's degree consists of 10 graduate level courses. Degrees from European universities in accordance with the Bologna Process (3+2) are recognized as Master's in Engineering. However, for various reasons, the 5-year degree offered by the School in most cases is not accepted internationally as such and this puts graduating students at a disadvantage (especially when they apply for enrolment in PhD programs). While consistent numbers for all Schools across the board are difficult to attain, it is nonetheless clear that a base of 56 courses is in fact excessive by today's standards.

Based on discussions with students and faculty, there are areas within the curriculum that should be re-evaluated in order to:

- eliminate any overlap in material between courses
- include field work throughout the degree program so that technical skills are reinforced both in 2<sup>nd</sup> and 1<sup>st</sup> year
- incorporate a fundamental computer programming course (in C++, JAVA, or similar) in the first year of study with subsequent reinforcement through projects in other courses over the term of the degree
- provide a mechanism for students to be able to take courses for credit outside the School (within the Faculty of Engineering)
- place, overall, a greater emphasis on survey law and computational programming

All interactions with students demonstrated that the provision of opportunities to work in teams on various projects/topics/themes throughout the duration of their studies is a very positive experience of the current curriculum and should be maintained.

Given the current and projected strain on resources, the current number of courses offered cannot continue at an acceptable functional level. The curriculum could be modified to better meet the needs of today's market so that students can be competitive in private industry as well as other organizations. The total number of courses offered should be reduced, possibly by merging courses with similar or repetitive content, a suggestion also made to the Committee by current graduate students of the School. In terms of functionality, the limited number of course pre-requisites result in some students taking senior level courses without having covered the basics. It also causes logistical issues when planning for classroom, laboratory and field exercises and undoubtedly result in an inefficient use of faculty resources. It is therefore recommended that the School implement a higher number of pre-requisites in its curriculum. The restructuring of the curriculum must involve input from all stakeholders in order to ensure that there is no overlap of course content and maximize opportunities for developing strengths in new and emerging topics.

The material for a typical undergraduate course includes electronic presentations/lectures provided to the students through Blackboard and/or course websites and high quality

textbooks authored by the faculty members of the School. The majority of the courses also include laboratory assignments conducted in the field and/or the computer lab. All assignments are handed out to the students at the beginning of the semester in order to allow for completion within a reasonable period of time. A suggestion by the committee is to have the various textbooks written by School faculty members translated into English and distributed to students.

Over the past several years, both the human and technical resources in the School have dwindled while the number of enrolled undergraduate students has increased. It is projected that the number of undergraduate students will increase by an estimated 40% in the 2013-14 academic year and the faculty, given their current age distribution and demographics, will progressively decrease over the next 5 years. In order for the School to be able to function and deliver a newly restructured curriculum, the available resources must be taken into account. While the human resource equivalent may be difficult to change, it is certain that students need access to modern-day survey and mapping equipment. At this point, it is also important to note that industry can play an important role by providing both training opportunities and equipment on a renewable basis. A collaborative agreement for the provision of such support will greatly enhance the student experience during the course of their studies.

## **RESULTS**

The educational standards of the School are high. The interactions between faculty and students are good and mostly constructive. The School provides a supportive environment for students to excel and innovate. For example, an undergraduate student has designed a web database that includes information about the curricula of geodesy programs from more than 100 universities in Europe. The work has received a lot of attention and praise internationally.

The level of the current set of academic courses offered is high. In the short-term, the School has responded to reduced resources (human, operational and equipment) by engaging more than one professor for individual courses and splitting large classes into smaller groups of students in order to allow for sufficient access to field equipment. This has resulted in high teaching loads with an average of 22 hours per week per faculty member. One manner to combat this issue is to have a mechanism whereby graduate students are teaching assistants (TA) for courses with laboratory/field work. In accordance with international standards, these TA positions could be compensated financially and thus provide graduate students with some support during their studies. This, in addition, will free up faculty for other teaching, research, and service activities.

The current operation in the School is somewhat ad hoc due to the various uncertainties arising from frequent legislative changes affecting the day-to-day activities. In order to allow the School to create a structured and strategic plan, there needs to be some confidence in the level of support, resources and size of undergraduate cohort in the future. The School is keenly aware of the fact that the current curriculum cannot continue to be offered at such a high quality without an increase in support. In the absence of an increase of resources, the School must focus on restructuring the curriculum. The faculty is adamant and fully devoted to not allow the quality of the program to be reduced.

## **IMPROVEMENT**

The School has identified the need to revise the curriculum in a manner that would allow it to retain the fundamental core courses at a high level without affecting the quality currently offered. Specifics on which courses (and/or streams of courses) should be eliminated or merged have yet to be decided. A systematic assessment of overlapping material/themes can be determined. Preliminary steps in this direction have started with some minor changes to



the program through the introduction of minimal pre-requisites and merging of some elective courses. The School plans to start the process of revising the curriculum as follows:

- Reduce the number of elective courses either by merging several courses with overlapping material or by eliminating courses.
- Introduce new courses deemed necessary in order for students to be competitive in industry and abroad.

## **A2: GRADUATE AND DOCTORAL PROGRAM**

### **APPROACH**

Post-graduate studies are offered as follows:

- a) The post-graduate specialization program in Geoinformatics (directions: High precision surveying control; Modern geodetic applications; Management of photogrammetric and remote sensing production in GIS environment; Water resources)
- b) The two-semester post-graduate specialization program in Spatial Analysis, Planning and Management Theory and Technology (directions: Cadastre and spatial data management; Cartographic production and geographic analysis; Organization and management of resources and development works).
- c) The six-semester (minimum) Doctorate program by research for those who attended the specialization programs and by courses and research for all others.

The School also participates in two interdepartmental programs:

- a) Protection, maintenance, and restoration of cultural monuments (with all Schools of the Faculty of Engineering)
- b) Planning, organization, and management of transport systems (with Civil Engineering).

The goal of each Master's level program is to provide an advanced and deep understanding of the subject matter through courses and a thesis that is based on a research topic decided on between the student and the supervisor. Since 2007 there have been an average of 8 doctoral students and 20 Master's students in each year of the program.

### **IMPLEMENTATION**

The graduate program involves a combination of advanced courses as well as research through a thesis (either at the Master's or Doctoral level). The number of graduate courses offered varies from 8 to 11 depending on the specialization. By international standards, this is a large number of required courses that should be reduced to a more manageable number. The Committee also suggests the evaluation of the requirement for a thesis for the two graduate specializations.

### **RESULTS**

Given that the undergraduate program is a full 5 years including a Diploma thesis on a specific research topic, it is not clear what the role of the graduate program is. In North America, for example, students in 5-year degree programs are granted entrance into a PhD program directly (without a Master's). In some European institutions, this is also the case. However, some programs may require a "Master's degree" before entrance into the PhD program. Therefore, it is strongly recommended that the 5 year degree be somehow redefined to satisfy the European equivalent of a Bachelor's and Master's in order to prevent the unfortunate situation where Greek students are required to study for at least 7 years (Bachelor's and Master's) before they enter a PhD program, whereas their counterparts in

the rest of Europe and North America can essentially complete their entire university studies (Bachelors' and PhD) in 8 years.

### **IMPROVEMENT**

The graduate program is an opportunity for the School to improve the economic and career opportunities for its students. However, in its current deployment, it cannot be competitive.

In general the program could be improved as follows:

1. All graduate theses should be written in English. The rationale for this is directly embedded in the need to provide the students with more and better opportunities upon graduation. An English thesis will provide (a) increased visibility of research, (b) more opportunities for exchanges of ideas, and (c) greater impact of research worldwide. This is also in line with current European university standards.
2. The graduate program should involve some level of tuition paid by the student in order to cover the expenses required to operate and maintain a quality program.
3. The graduate program provides an excellent opportunity for industry involvement. Discussions of the Committee with former students currently working in local private industry were very positive and members showed enthusiasm with the idea of being more involved with both undergraduate and graduate students. One way to achieve this is to invite industry members to participate in the student's thesis work. Students also identified the desire to be more connected/networked with professionals and industry, as it would help their transition from life as a university student to life as a practicing professional engineer. In today's market, there is no place for isolation of research from practical implementation.

There is a general sense that the current graduate program is isolating for the students. Key methods to improve this are to provide students with the financial support to attend international conferences. Currently €800 is allocated for PhD students to attend one conference during their studies. Dedicated funds for Master's students have not been identified. Other possibilities for improving the graduate student experience include more productive contact with industry, establishment of a graduate student council, ability for students to take courses of interest outside their current School (e.g., computer programming in JAVA or C++, signal processing, etc.), support for invited seminar speakers from industry, other universities, and research organizations. Outreach activities involving alumni would also be extremely beneficial for students.

## ***B. Teaching***

### **APPROACH**

The School has made the quality of teaching a priority and has always strived to provide the highest level of instruction. The teaching methods used vary depending of the subject matter. Many courses use electronic presentations, combined with class demonstrations of instruments and methods, and/or the use of the blackboard to solve problems and clarify concepts. Due to the nature of the course material, there are computer labs and field exercises, which provide valuable practical experience to the students. The majority of the courses provide textbooks plus teaching and lab material electronically by use of Blackboard and e-Topo, the latter being a system developed by the School, as well as through the web sites of the course instructors. Online resources are routinely used by the course instructors for posting teaching materials, such as lecture notes, assignments, sample problems and their solutions, as well as additional reading resources for each course.

Overall, the teaching means and resources are quite good. Information technologies are also utilized regularly for teaching, not only through the use of electronic materials but also via the use of networked computers and web tools and resources. The availability of software and computers, and the access to computer labs seems to be very high. In terms of space resources and infrastructure, the School has good classroom, auditorium, and laboratory facilities. The on-site visit, however, demonstrated that these have not been properly maintained due to the lack of funding for maintenance and renovations. The laboratories in particular seem to be very much run down and in immediate need of improvement, both in terms of space and in terms of old instruments that need to be repaired, updated and/or replaced by newer ones. The number and capacity of classrooms and auditoria have been sufficient in the past. This however is about to change as the existing capacity is inadequate to accommodate the new, significantly increased number of undergraduate students allocated to the School. This, in addition, will create a problem in the delivery of the curriculum since large classes will have to be split into smaller sections in order to fit in the available space and, therefore, require additional teaching personnel that is not currently available.

In the last five years, the ratio between teaching staff and students has remained almost constant, ranging between 4 to 5 instructors per 100 students. With the recent increase in the number of students entering the program, this ratio will be reduced significantly (almost to half its current value), which will have serious repercussions on the quality of instruction of the undergraduate curriculum. This problem has also been compounded by the decrease of the already very low ratio between other teaching personnel (technicians, under contract, ΕΕΔΙΠ) and students (1 per 100 students in the 2010-11 academic year) that became practically zero in the academic year 2012-13. The School has been forced to reduce the contact hours in courses with significant lab component and the danger is that the quality of instruction in this type of courses will also suffer severely.

Even with the problems mentioned above, the student-teacher collaboration has always been excellent. The students have very good working relationships with the faculty members, which has contributed to a very nice academic environment and the smooth functioning of the School. The student-teacher collaboration extends beyond lectures, with the students having full access to faculty members to discuss their progress, course assessment, laboratory work, and future plans related to employment or continuation of studies at the graduate level. The above were verified not only through discussions with the faculty members but also in the face-to-face meeting of the Committee with the current graduate students in the School, who confirmed this collaborative atmosphere and expressed their satisfaction with the help they were receiving from the course instructors.

Regarding examinations, in most of the courses there is a final written examination. In the courses that require laboratory or field work, part of the final grade comes from these components. The assessment of courses is typically tailored to the particular nature of each course and the expected level of knowledge that the students should acquire. It was mentioned that grading is not consistent between the various Departments of the School but the evaluation Committee had no way of verifying this.

### **IMPLEMENTATION**

The Committee judged the quality of teaching by use of only the course material available online because the School did not provide any teaching materials in hardcopy form as they had not been informed that this was required for the site visit. All instructors have made a great effort to deliver their courses as best as they can. The electronic course material is brought up to date through the electronic platform that each professor uses to administer her/his courses. Due to the wide range of topics and the very large number of courses offered in the three Departments of the School, the teaching materials used vary a lot in style and quality. It is worth mentioning here that there is a large number of books written by faculty members – in particular in the Department of Geodesy and Surveying – as a result of the constant updating and improvement of lecture notes prepared for many of the courses taught by the School. These books are provided to the students and are of very high quality. The Committee in fact feels that they should be translated into English so that they can be used as teaching resources internationally.

Many of the faculty members in the School have very active programs of research, many with international collaborations and recognition beyond the borders of Greece. This has enabled them to incorporate their research findings in their teaching, to update and enhance their teaching materials to reflect the current state of the art in their respective fields, and to involve students in research projects. In the last five years, 51 undergraduate students have participated in research projects, mostly in relation to their work for their undergraduate theses. Of course, this is standard practice for graduate students. In the last year, for example, 10 graduate and 8 doctoral students have participated in various research activities of the School. At the graduate level, several students are also involved in inter-departmental projects and research work, a practice that should be further promoted and extended to new areas of collaboration between this and other Schools (not only from Engineering but also from Science, Medical and/or Social Sciences, wherever synergies are identified).

Many faculty members have international research collaborations, and are trying to participate in national and international conferences and visits at other institutions. With the current economic uncertainty in Greece in general and the resulting reduced academic funding in particular, international presence has become very difficult for both students and faculty. In the last several years, the average number of faculty members visiting other universities for teaching and research activities has been no more than two per year. This is also the number of researchers and professors visiting the School from other countries. It is encouraging, though, to see that those faculty members that maintain a program of funded research have not stopped attending conferences and presenting their work to the international scientific community. Students are also offered international mobility, mainly through the ERASMUS program; the School has signed 9 (now 13) such agreements with other European universities. The student interest in the ERASMUS program has increased steadily in the last five years. In particular, 13 foreign students came to the School and 24 Greek students visited universities abroad. In addition, 4 students from the School have used the ERASMUS Student Mobility for Placements Program, which offers the possibility of spending an internship period in an enterprise or organization of the participating country. A barrier to further increasing the number of such student exchanges is language. The School should therefore seriously consider the possibility to (a) offer courses, and in particular the graduate courses, in English and (b) encourage students to write their theses in English.

The evaluation of all undergraduate and graduate courses by students is done electronically through the system provided by ΜΟΔΙΠ-ΑΠΘ. Unfortunately, student participation has been extremely low, which cannot provide the School with reliable results for teaching and course improvement. The School should consider providing incentives to the students to complete these evaluations and/or, alternatively, to consider a printed form for such evaluations. Special care must be taken so as not to make this process very tedious by, e.g., keeping the number of questions low and the clarity of the questions high. The questions should be such that both the quality of the course and the effectiveness of the instructor can be assessed.

## **RESULTS**

A Study Guide is given to the students entering the School. This is an extensive and very useful document providing information about the curriculum, the course content and course material, the graduation requirements, the facilities, the Departments, and the post-graduate programs and research activities. Information about support services related to the wellbeing, employment and mobility of students is also provided. However, it has not been updated for several years, and this should be done as soon as possible. The School has no standard policy regarding informing the students about the learning outcome of courses and monitoring whether these outcomes have been achieved or not; such a policy should definitely be developed and implemented.

There are different rates of success in various courses but, given the plethora and wide range of available courses, this is to be expected. It was also observed that the grading ranges vary between the three Departments; an effort should be made to standardize the course assessment and grading throughout the School. In the last 6 years, the average overall grade of graduating students is almost constant in the range 7.1 to 7.3. From the quantitative summaries provided to the Committee it can be seen that there is a large number of students who take longer than 5 years to graduate but the data provided are not sufficiently detailed in order to detect specific patterns and pinpoint the exact reasons for this.

The School attributes the reasons behind longer graduation times and particular course and diploma grades to the lack of sufficient positions in teaching, laboratory and support personnel, the need of students to work during their studies in order to be able to cover their expenses, and the lack of employment opportunities (and thus motivation to finish on time) for the graduating students. A lot of these deficiencies are due to the current socio-economic situation in the country, which require the commitment and support of the State and therefore cannot be improved by the School itself.

## **IMPROVEMENT**

In the 2012-13 Annual Report of the School, it was mentioned that both the undergraduate and graduate education activities took place without major problems. The students' interest both in ERASMUS and in the graduate programs offered by the School was higher than usual, primarily due to the lack of employment opportunities. The negative trends identified both by the School and by the Committee in its site visit were attributed to factors such as:

- high, and recently further increased (by 40%), number of admitted students;
- reduction of administrative staff positions;
- reduction of technical staff positions;
- expected retirement of several faculty members and other personnel;
- lack of funding for the upgrade and modernization of lab facilities and equipment; and
- insufficient space capacity for the academic and research activities of the School.

From the above, the only initiatives that can be taken by the School and the University to remedy the situation have to do with the reallocation of positions of remaining support, and in particular administrative, staff of the University. This is required primarily in order to

ensure the students' access to the required equipment for their lab and fieldwork, and the uninterrupted operation of the PC/computing facilities required for the completion of the coursework and lab work of the students. Space related issues can be partially resolved by freeing the space currently occupied by the General Department and the lab for Civil engineers and Urban Planning engineers, provided that the Faculty of Engineering can provide them with space in another building. Of the remaining factors listed above, none depends on the School itself, and as a result it is difficult to see an immediate improvement in these areas unless the State decides to reduce the number of admitted students, provide new permanent positions for teaching, technical and administrative personnel, and increase the overall operating budget of the University. Considering the current state of the Greek economy and the inherent inflexibility of the Greek system, it is unlikely that any of the above problems will be corrected satisfactorily any time soon. The Committee feels, however, that one way that the School can contribute to the improvement of its educational activities is the redesign of its curriculum that will decrease the huge proliferation of courses that exist now, which require an enormous amount of resources for their delivery.

## **C. Research**

### **APPROACH**

The School has a rich history of internationally recognized research excellence that includes, besides significant dissemination of research work, participation in international collaborative research projects, leadership positions in scientific and professional organizations, and major national and international awards. Nevertheless, the facts and statistics presented to the Committee indicate that research is an area given extra weight by the majority of the members in all Departments primarily because of personal interest and motivation. The School is ranked highly within the School and the University in terms of research funding. For the period 2008-12 it ranks 2<sup>nd</sup> in the University in faculty participation in research programs, 4<sup>th</sup> in funding per faculty, and 8<sup>th</sup> in absolute funding (according to the presentation by a member of the University's ΕΠΙΤΡΟΠΗ ΕΡΕΥΝΩΝ).

The multitude of research areas and the quality of the executed research in the School and its Departments is highly dependent on the exposure of its faculty to the results obtained by similar institutions contemporarily. Although faculty members participate in international conferences, in general, travel funds are very limited and so are the opportunities for every faculty member to interact with their international peers. Those that participate are often faculty with research grants that are primarily the source of their research funding and associated travel.

The School can benefit from a more formal process for research assessment, through regular evaluation of the activities and research productivity of the individual faculty members. The only institutional process currently in place that reviews and evaluates research outcomes is that of the reviews for the promotion of each faculty member from one level to the next. There are no set standards for research efforts, other than those associated with the promotional process. It is stated that the School reviews the progress of research projects during their regular general assemblies at the School or Department level.

The expected retirement of a number of faculty members in the near future provides an opportunity for the School to develop a strategic view for targeted research areas where they would like to develop and identify approaches to implement them (despite the fact that very few of these positions may be replaced with new faculty in the future).

### **IMPLEMENTATION**

Although the School values research efforts, it has no way to effectively support and reward them, other than through the requirements set for promotion of its faculty members. There is a clear lack of Institutional support in research proposal preparation and management. Despite the fact that this University is among the largest in Europe, it lacks an "Office of Sponsored Research--OSP", a standard accessory at foreign universities. The lack of such a formal focal point for research has severe repercussions for the faculty as well as the University. The faculty is now solely responsible for the development of the proposal in response to every announcement of opportunity and, when successful, the administration and execution of the ensuing project. The Committee feels the availability of a central, university-wide office of sponsored research will ensure that professional support will be available to all faculties, with equal access and know-how, for the development of successful proposals, guidance within the usually extensive paperwork required by the funding sources, and competent financial administration of the successful proposals.

The institution of such a central service can also be used as the starting point for the development of a badly-needed entity that will guide the Schools in their research efforts, act as an advocate at the national and international level, and a conduit between the University, its Schools and the funding sources, whether national or international. Most foreign universities recognize the importance of such an office and they usually place in charge of it a

Dean responsible for research planning and administration.

Implementation of a strong research program in any Engineering School today is highly dependant on the existence and support of a powerful and modern computational facility. Although this is imperative for graduate studies and research, it is highly recommended for the undergraduate program as well, since those students will in most cases face the latest computational hardware and software once they join the working ranks upon graduation. The School does a good job, given the circumstances, covering up until recently, hardware and software needs for teaching. A review of these facilities indicates that they are out-dated, difficult and expensive to maintain. Furthermore, due to an expected increase by ~40% in the number of accepted new students, very soon they will be inadequate to cover their needs. It is highly recommended that the University establish a central computing body that will serve all Schools, provide access to state-of-the-art hardware and software with applicability in all areas of teaching and research covered by the University Schools, and support the programming needs of all these entities centrally. The School could then invest in replacing the out-dated individual PC-based computational “islands” with simple terminals connected to a central server or cluster. This will cut down significantly in the cost of expanding these facilities as the student numbers increase and replacement of the key component (the server or cluster) will be possible at more frequent intervals, to keep in pace with technological advancements. In general, clusters provide a scalable solution that is far cheaper and easier to maintain. This approach will also lessen the problem of limited space availability and lighten the burden of the faculty responsible for the support and maintenance effort at the currently utilized “computational islands”. It is imperative that the establishment and maintenance of an up-to-date computational facility be decoupled from the individual Schools and provided centrally by the University as a necessary infrastructure item.

## RESULTS

The School is known nationally and internationally. Several faculty members have been recognized with honor positions as well as national and international awards. One faculty member serves as Editor of the Journal of Geodesy, another as Editor of Geodetic Science, and a third one as Associate Editor of Geophysical Prospecting. A fourth faculty member founded e-Perimetron, an international web journal supported by School funds, and serves as its Executive Editor. Another faculty member founded the South-East European Journal of Earth Observation and Geomatics, a regional web journal, and serves as its Editor. Two faculty members have been recognized with the prestigious award “D. Lampadariou” from the National Academy of Athens, and another faculty member received a “Best Paper” award from the European sub-commission of the European Geodetic Reference Frame. In addition, four faculty members have received the very selective Alexander von Humboldt fellowship from the Alexander von Humboldt Foundation. Furthermore, five faculty members have been recognized as Fellows of the International Association of Geodesy. In addition to faculty members, PhD students have also received prestigious international awards (for example, the EUREF Best Poster Paper Award).

Several faculty members of the School have been selected to serve on leadership positions of national and international societies. A faculty member is Honorary President of the International Scientific Committee for Documentation and Architectural Photogrammetry; another is the Chair of the Commission on Digital Technologies in Cartographic Heritage of the International Cartographic Association; a faculty member is the Chair of the Joint Study Group on Future Developments in ITRF Models and their Geophysical Interpretation of the International Association of Geodesy. In addition, a number of faculty members are active in service for the International Association of Geodesy, the International Society of Photogrammetry and Remote Sensing, and the International Cartographic Association

The School has a very rich publication history covering all types of publications, with the vast majority appearing in refereed proceedings and credible refereed journals devoted to the



topics associated with each Department or research topic that is reported. There is a steady production of monographs and books by the faculty members, on average two per year over the recent past. All Departments of the School seem to be active in publishing their research and communicating it to wider audiences. The statistics on cross-referencing indicate a steady increase in the recent past. For evaluation purposes, as well as the meaningful tracking of the School's achievements, it is suggested that they track the ranking of their publications via some independent and credible service.

The School has a significant piece of work in authorship of scientific books, textbooks, monographs, etc. This significant achievement though, is hardly recognized beyond Greece, since these works that are all in Greek, cannot be used by the broader scientific community in the disciplines covered by the School.

The faculty draws research funding from many different sources. The majority comes from the diverse national sources that fall under the umbrella of the ministerial offices that are related to the research subjects covered by the grantees (e.g., Ministries of Education, Economy, Transportation, etc.), as well as the regional government (e.g., the prefectures, the cities, the major roadways, etc.), local and national private enterprise, the European Commission, the European Space Agency, etc. On average, five members served as coordinators over the most recent six years, while three members participated as partners. Over the same period, one member was funded by an international organization or program and three members held management positions in academic/scientific research organizations or agencies.

The faculty should continue taking advantage of funding opportunities and even increase participation in research initiatives and collaborative research projects, something that gives them the opportunity to travel to conferences (especially outside Greece) and enjoy well-deserved international recognition.

The research projects that are carried out by the members support several areas of applications that are of benefit to the local, regional and national community. A number of research collaborations exist and the School has laid the foundations to further develop them, both internally at the University and externally with European partners. Examples include the collaboration with sister Schools (e.g., Geophysics, Seismology, etc.) that would also lead to an expansion of research areas as well as attract more students with graduate and post-graduate aspirations.

### **IMPROVEMENT**

There is significant and impressive research activity in all Departments in the School. The Committee, while impressed by the range and quality of activities, recommends that developing a strategy on future research directions (either new or existing) and their development (including collaborations and synergies) is very important.

Despite the uncertain operating environment due to frequent changes in the legal frameworks that govern the operations of Universities, the School should develop an overall research strategic plan based on the known strengths of its faculty members, the needs of the student community and society, and anticipated future opportunities. The development of strategies should be comprehensive and include not only research areas, but also look at the needs for training PhD students, support for their participation in international workshops and conferences, and overall increased interactions at the international level.

## **D. All Other Services**

### **APPROACH**

The School with its secretariat and technical personnel provides administrative and technical support to its faculty and students. The technical support is responsible for the operation of the research and computer laboratories. The School has its own website and provides access to faculty webpages, course material, library as well as grades. The older files that are in the office of the secretariat are in the process of being digitized.

The adaptation by the Faculty of Engineering of an electronic management system has increased the efficiency of the services provided to the students and faculty. Students are able to register electronically for courses and submit course evaluations at the end of the semester. The School is currently supported by only two administrative employees.

The School has computer laboratories as well as surveying and GPS instruments available for student use. These facilities are considered essential for the educational mission of the program, which includes lectures, laboratories, field measurements and analysis; in addition, they increase the physical presence of students on campus.

### **IMPLEMENTATION**

The School is housed in its own building with space for classrooms, research and computer laboratories as well as administrative and faculty offices. There is one classroom that can hold more than 100 students. Personal computers equipped with necessary software and surveying equipment are available to the students.

The Secretariat of the School is run by two permanent administrative employees. The three Departments are supported at the present by one permanent administrative employee. Three permanent specialized technical employees (ΕΤΕΠ) and four employees with a private contract of infinite duration (ΙΔΑΧ) are involved in the operation of all service units (computer laboratories and depository of surveying instruments), teaching assistance in laboratories of various undergraduate or postgraduate courses, and miscellaneous administrative support tasks.

The School library will move to the new library of the Faculty of Engineering, where a librarian is available. Free Wi-Fi service to all AUTH members (faculty, staff, and students) is available in most of the campus. Student counseling exists (one faculty per Department) and all students are encouraged to make use of the service. However, due to the excellent relations between faculty and students, students are often advised by the faculty of their choice during different phases of their studies. The students participate in the internal AUTH basketball and football championships. Also a film club (Κινηματογραφική Ομάδα Τοπογράφων, ΚΟΤΑ) is very active with regular screenings in one of the lecture rooms.

### **RESULTS**

The available administrative and technical personnel for supporting the academic and research programs of the 31 professors has been drastically decreased. This, if not corrected soon, will no doubt not only lead to reduced services but will also have a detrimental effect to the delivery and the quality of the academic program of the School.

### **IMPROVEMENT**

Reorganizing the duties of all remaining administrative and technical personnel is necessary. Unfortunately this reorganization would mean lowering the present level of academic services. For example, the opening hours of the computer laboratories have already been reduced from 9:00-17:00 to 9:00-14:00, with a possible further reduction in the near future.

### **Collaboration with social, cultural and production organizations**

Several faculty members as well as undergraduate and postgraduate students have participated in collaborative development projects with municipalities and agencies in Greece and Cyprus. Most of these projects had significant social impact, and their results were presented to the public via seminars, workshops, exhibitions, and educational programs for children as well as the daily press. Other results were presented at conferences and published in scientific journals. Through the educational program, field trips are often organized for students to visit social, cultural, and production organizations.

The School has a strong presence in Greece and has had a significant impact in the following areas: (a) university life of Greece, (b) social and institutional life of the country, (c) scientific, engineering, and cultural life, and (d) international scientific collaborations. Some specific examples are given below.

Three faculty members (a former and two current) have served as top rank University officials, e.g., Vice-Rector of the University, Dean of the Faculty of Engineering, and Vice-President of the University of West Macedonia. Faculty members have contributed to the establishment of new universities and university programs in Greece, e.g., the Technical University of Crete, and the School of Architecture in the Faculty of Engineering of the Democritus University of Thrace.

In the last two years, two faculty members (a former and a current) have served in top positions of the Hellenic Republic, as heads of the Ministry of the Environment, Energy and Climate Change, dealing among other issues with geospatial planning, cadastre and mapping, forestry, surveys and management of natural resources, all associated with the teaching and research activities of the School. Two current faculty members have served as presidents of the National Cadastre and the State Mapping Public Agencies of the country.

Faculty members have founded and run the Hellenic Cartographic Society, now an active national member of the International Cartographic Association. They have organized more than 10 times the Hellenic Cartographic Conference in collaboration with Greek Universities, Local Administration, and Professional Unions. Furthermore, faculty members founded in Thessaloniki and run up to 2012 the National Centre for Maps and Cartographic Heritage, which from 2013 is an independent institutional section of the General State Archives of Greece, as the Archive of Cartographic Heritage.

Since 2005, faculty members and doctoral students have organized the Annual International Workshop on the Digital Approaches in Cartographic Heritage which has been held until now in seven European cities, in cooperation with three European Universities, three European National Libraries, and four European State Archives, Research Institutes, and Museums. This activity is officially endorsed by the International Cartographic Association.

### ***E. Strategic Planning, Perspectives for Improvement and Dealing with Potential Inhibiting Factors***

In order to accomplish its research goals and fulfil the professional needs of the graduating students the faculty of the School is involved in a wide range of educational and research activities. Research and educational objectives are met as evident from these activities, as well as publication record, awards, and the overall exemplary teaching performance.

The School did not provide a recent formal strategic plan. The faculty plans a curriculum review in the Spring of 2014. Strategic issues are discussed in School meetings and the various committees (mainly for educational matters). It is clear that the main concerns of the faculty are the freeze in hiring to replace retired faculty (with 3 more retirements expected in the next 2-3 years), the reduction in support staff, and the increase in the number of admitted students.

The faculty considers that the rapid decrease in supporting technical and administrative personnel presents one of the main problems for the continuation of the teaching and research activities at the same level to date. In addition, without the purchase of additional equipment (and the limited size of various facilities, e.g., design studios) it is required that several courses be taught in split sections, which will increase the faculty workload and the demand in classrooms. In any case, an increase of technical and administrative personnel is necessary. School and Faculty of Engineering strategic plans should also include financial support for PhD students and Post-Doctoral fellows. PhD research is currently not supported financially.

Based on the Internal Evaluation document and the discussions with the faculty, a number of goals have been identified. In the short term, an important priority for the School is maintaining an adequate level of administrative personnel, as well as technical and laboratory personnel. Replacement of antiquated equipment is also a critical short-term priority. In addition, the maintenance of facilities is a concern. Hiring graduate students and/or professional engineers for certain courses, e.g., involving computer labs and managing the instrument depository, are some of the alternatives that could be considered.

Medium term goals focus on several important items. Securing approval for 3 pending laboratories is important for the School. Curriculum adaptations aiming at a greater synergy among geoinformatics, hydroinformatics and transport planning are being considered as medium term goals. In addition, the revision of the offered post-graduate programs, including the promotion of theses written in English, and eventually the introduction of English as the official language of post-graduate instruction, are important long-term priorities. Other action items include the increase of inter-School collaborations and cooperation across educational and research programs and disciplines, and considerations for small-scale changes to the current undergraduate curriculum, especially focusing on elective courses of similar content.

The School is considering a number of actions for improving the current situation. The number of admitted students for the current academic year was increased by ~40% by the Ministry compared to previous years. The School will lobby to decrease this number and return to previous levels. Allocating permanent administrative and technical personnel objectively according to actual needs and production, is a crucial strategic priority that the School will argue at higher levels. This is an important prerequisite for viable operation of any School, if current standards are to be kept or improved in the future.

A number of faculty members will be retiring in the forthcoming years. The renewal of faculty is deemed necessary for a successful future. A specific example of the difficulty the School faces in this regard is the pending finalization by the Ministry of the appointment of a new Professor whose hiring was approved in 2010.

While the goals and action items outlined above, as presented by various members of the School, address the needs and identify some solutions and action items, they focus, in some cases, mostly on the symptoms of the main problems. Uncertainty and frequent changes in legislation, as well as lack of permission to make decisions on critical issues that concern the School, inhibit or make strategic planning exercises obsolete. However, it is important that the School recognizes and accepts that, at least for the foreseeable future, conditions in terms of funding have changed. In order for the School to continue being successful it is important that it also develops a strategy for dealing with some of the issues from within.

## ***F. Final Conclusions and Recommendations of the EEC***

The School is performing very well in its educational and research mission. The faculty has very good international reputation and received a number of national and international awards. Students (both undergraduate and PhD) have also been internationally recognized for their service and research contributions. The main challenges it will face moving forward include the reduction in internal funding, size of the faculty, and size of support personnel, compounded by the recent increase in the number of incoming students. The increase in the size of the student body started with the academic year 2013-14 and will become more acute in future years. As such, there is now a good opportunity for the faculty to identify opportunities in light of the external constraints outside the control of the School. It is expected that in the foreseeable future:

- the budget will not increase
- new faculty positions will be scarce
- student population may increase
- undergraduate and graduate student interest in pursuing further studies or even careers abroad may increase

Under these conditions the School will find it difficult to maintain the present level of activities at the current standards. Therefore, it will benefit from initiating internal discussions that focus on the following:

- Identification of economies of scale in the various activities of the School but also across the Faculty of Engineering (short-term)
- Re-allocation of resources and efforts to higher priority activities, such as emphasizing skills that are in higher demand and increase the marketability of students, both nationally and internationally (short-medium term)
- Increase in collaborations internally and externally (short-medium term)
- Identification of potential new sources of income to supplement existing resources and launch new research initiatives (medium-long term)
- Increasing the internationalization of the School (medium-long term)

More specifically, suggested actions for further consideration by the faculty include:

### **A. UNDERGRADUATE EDUCATION**

1. The undergraduate curriculum has a large number of courses. There are more than 100 courses listed of which 67 are electives. As a result, the teaching load for the faculty is rather high (estimated at 22 hours/week on the average per faculty). In addition to an effort to maintain an equitable distribution of the educational workload, the faculty should identify any opportunities for consolidation of courses and related activities.
2. Students have expressed interest in renewing/modernizing and strengthening the computing component of the program with exposure to current, general purpose programming languages, as opposed to only relying on MATLAB and Microsoft based products. This is viewed as an example of a broader re-examination of the curriculum and introduction of educational elements that can increase the students' employment prospects and opportunities. In developing these plans the School may seek collaborations with other Schools that can provide some of the basic services needed.
3. Introduction of strict prerequisites for courses will help define the sequence of courses for the students. More importantly, establishment of prerequisites can help reduce potential material overlap and repetition among courses and therefore increase opportunities for potential consolidation.
4. The educational program, due to the nature of the School, includes a fair amount of

laboratories and field exercises. Under the current conditions the School will need to increase the staff and equipment required to carry out these activities at their usual high quality standards. Considering the available resources it is essential that the School consider hiring graduate and PhD students, as well as professionals from local engineering firms (preferably recent graduates of the Program) to assist in, and even carry out, some of these teaching activities. This can be a cost effective means to fulfil certain, time consuming, educational responsibilities and allow regular faculty members more time to allocate to research, development of new initiatives and collaborations.

## **B. POST-GRADUATE and PhD EDUCATION**

The planning and strategic development of the post-graduate program has suffered from a number of changes in the legal framework that govern its operations. According to accounts there have been 5 different legislations in a period of 3 years and this has led to frustration in defining overall goals. In any case, a number of recommendations are proposed for consideration.

1. Economies of scale may also exist in the post-graduate programs. The current one-year program requiring 8-11 courses and a thesis is very ambitious. Some of the courses have certain overlap with corresponding undergraduate courses and could be combined potentially in a single course. Such a course could be designated as more advanced for undergraduates and include an extra unit or a section for the post-graduate students.
2. Under the current structure students cannot take courses from other Schools and receive credit that will appear in their academic transcript. Allowing this flexibility can benefit both the student and the School in the following ways:
  - a. Introduces a truly interdisciplinary background that will increase student marketability and their chances of being accepted to graduate programs abroad.
  - b. Allows the School to strengthen ties with other Schools and potentially develop collaborative relationships at various levels.

The School should lobby and assume leadership in the Faculty of Engineering to introduce a mechanism that will allow cross registration of students in subjects from other Schools, especially at the post-graduate and PhD levels.

3. While students are permitted to write their theses in other languages, the approval process inhibits many of the faculty in pursuing this option. The School should lobby for the University administration to simplify, and if possible, automate the process of choosing the language of the thesis. It should also make an effort to inform the students about the availability of this option. Increasing in general the number of the scientific products that are written in English offers a number of strategic advantages:
  - a. Increases the visibility of the School internationally and facilitates the development of broader collaborations.
  - b. Makes students more competitive in the market.
  - c. Strengthens students' applications for postgraduate positions abroad.
4. The language of instruction for graduate courses should be changed to English. Maintaining Greek as the language of instruction deprives the School of taking full advantage of a number of initiatives that its faculty have already created or are involved in. A clear example is the ERASMUS program. Few students from other universities are now able to participate due to the language barrier. An increased participation of ERASMUS students can clearly increase visibility and international collaborations, and even contribute to the local economy.
5. The School should consider the introduction of fees at the post-graduate level and seek the support of the University in doing so. The details for the implementation of such a program (amount of fees and for whom) is outside the scope of this report.
6. The School should work with the Faculty of Engineering to identify suitable definitions of the post-graduate program, in light of the 5 year undergraduate program. It should also target the development of an acceptable solution to the problem of the international

recognition of the first degree as equivalent to a Master's degree. This will result to graduates of the School being qualified to enrol directly to PhD studies abroad.

### **C. RESEARCH**

The faculty have developed a high quality research program in a number of areas. The School ranks 4<sup>th</sup> in the entire University in funding per faculty. The funding sources include private companies, national programs, NSRF, and EU programs. In the context of these activities the faculty have developed a number of valuable "assets" especially in the form of equipment, unique databases, networks of GPS sensors and tide gauges. These unique assets can be used to attract further funding of various forms both, at the national level and internationally. In particular efforts should be placed on:

1. Use of the instruments, databases, and sensor networks, to leverage partnerships in order to pursue EU funding where possible.
2. Strengthen the participation in EU-funded programs such as COST, TEMPUS, etc. Programs such as COST can help the mobility of junior faculty and PhD students, as they offer support for meetings, short scientific missions, participation in summer courses (particularly useful for PhD students), etc. They also facilitate the development of research partnerships.
3. Identify research areas of opportunity to expand or redirect current activities. Examples include satellite Earth observation, environmental monitoring and modelling, biomedical engineering, geophysics/seismology, just to name only a few. Furthermore, stronger interactions could be sought with urban and regional planning groups, industrial partners, national institutes, and ministries in relevant areas of common interests (e.g., transportation, energy & environment, defense, etc.).
4. Improve the exposure of faculty and students to international research, through seminar/short course series where international experts are invited on a regular basis and student attendance is expected and graded as part of their semester work.

### **D. OTHER**



1. Interactions with industry can be enhanced and take several forms, including Diploma theses, graduate theses, invited seminars, workshops, internships and planned opportunities for student-faculty-industry liaison.
2. Space can become a critical issue in the future and needs to be dealt with in a coordinated fashion at the Faculty of Engineering. Currently classrooms are allocated to each School and used almost exclusively by the corresponding School. However, this decentralized approach to space is inefficient. The recent initiative by the Faculty of Engineering to consolidate the libraries of the various Schools is a good example of initiatives in this direction already in place. Other areas, in addition to space (e.g. computing) are also good candidates for a more centralized approach.
3. Maintenance of facilities, laboratories, and equipment is below critical level and funding is needed to improve the situation.

While building a strategy for the future is a necessary condition for moving forward successfully, it is by no means sufficient. The general environment under which a School operates is critical in promoting creativity, innovation, and initiative. It also requires:

1. Greater autonomy in governance.
2. More stability and consistency in the external frameworks that are outside the control of the faculty and which govern the various aspects of the operations of the School.
3. Increased stability in funding and adoption at the national level of a long-term view and strategy for higher education.



## The Members of the Committee

Name and Surname	Signature
1. Harilaos Koutsopoulos _____	
2. Michael Sideris _____	
3. Ericcos Pavlis _____	
4. Georgia Fotopoulos _____	
5. Sotira _____	Yiacoumi 