



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
Α.ΔΙ.Π.
 ΑΡΧΗ ΔΙΑΣΦΑΛΙΣΗΣ ΚΑΙ
 ΠΙΣΤΟΠΟΙΗΣΗΣ ΤΗΣ ΠΟΙΟΤΗΤΑΣ
 ΣΤΗΝ ΑΝΩΤΑΤΗ ΕΚΠΑΙΔΕΥΣΗ

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

EXTERNAL EVALUATION REPORT

SCHOOL OF MECHANICAL ENGINEERING AND AERONAUTICS

UNIVERSITY OF PATRAS



European Union
 European Social Fund



MINISTRY OF EDUCATION & RELIGIOUS AFFAIRS, CULTURE & SPORTS
 MANAGING AUTHORITY

Co-financed by Greece and the European Union



External Evaluation Committee

The Committee responsible for the External Evaluation of the Mechanical Engineering and Aeronautics Department (MEAD) of the University of Patras consisted of the following five (5) expert evaluators drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005 :

1. Professor Panagiotis Tsiotras (President)
 (Title) (Name and Surname)
School of Aerospace Engineering, Georgia Institute of Technology,
USA
 (Institution of origin)

2. Dr Fivos Andritsos
 (Title) (Name and Surname)
European Commission, Joint Research Center, Italy
 (Institution of origin)

3. Professor Xanthippi Markenscoff
 (Title) (Name and Surname)
Dept. of Mechanical and Aerospace Engineering, Univ. of California,
San Diego, USA
 (Institution of origin)

4. Professor Soteris Kalogirou
 (Title) (Name and Surname)
Dept. of Mechanical Engineering and Materials Engineering, Cyprus
University of Technology, Cyprus
 (Institution of origin)

5. Professor Stelios Kyriakidis
 (Title) (Name and Surname)
Department of Aerospace Engineering and Engineering Mechanics,
The University of Texas at Austin, USA
 (Institution of origin)

Introduction

I. The External Evaluation Procedure

The External Evaluation Committee (the Committee) visited the Department of Mechanical Engineering and Aeronautics (the Department) of the University of Patras during the period of 16-19 December 2013.

The Committee arrived at the University of Patras campus at Rio in the afternoon of December 16th and met with the Deputy Rector of Academic Affairs, the Dean of the School of Engineering, the Department Head, the members of the Quality Assurance Unit (ΜΟΔΙΠ) and the members of the Department's Evaluation Unit (ΟΜΕΑ).

During its visit, the Committee attended a series of presentations by the faculty, in which the following were highlighted: the Department's undergraduate and graduate program, the past and on-going industrial collaborations, the research activities of each Division (Τομέας) in the Department, as well as the research activities of each separate Laboratory (Εργαστήριο) within each Division. The Committee was given extensive and informative tours of the entire Department's educational and research Laboratories, including demonstrations of their capabilities.

The Committee on several occasions requested clarifications and additional information, all of which were responded to by the Department. In addition to joint meetings with the whole faculty, the Committee also met with selected emeriti and retired professors and discussed the historical development of the Department since its inception in 1972. The Committee also interviewed separately, and in private, with the non-tenured faculty, the women faculty, the Departmental secretariat staff, the Departmental technicians (ΕΕΔΙΠ and ΕΤΕΠ), and a group of approximately 30 doctoral students. The Committee also had the opportunity to meet with approximately 50 undergraduate students in a lecture amphitheater, without the presence of either the instructor or any other faculty members.

A scheduled walk-through of the library, the athletic center, and the cultural and conference center was replaced (due to lack of time) by a short drive-through tour.

The Committee also had a short, but cordial, meeting with the Rector of the University of Patras, Prof. George Panayotakis, during which the University of Patras authorities expressed their appreciation for the work of the Committee and their intention to follow-up with the evaluation procedure.

During its deliberations, the Committee took into consideration the following documents provided by the Department:

1. The 2011-2012 Internal Evaluation Report (IER)
2. The Department's program of studies
3. Hard copies and electronic copies of all presentations
4. Samples of course textbooks, Diploma Projects (Σπουδαστικές εργασίες) and Diploma theses (Διπλωματικές εργασίες)
5. Additional brochures and information provided by the various Divisions and Laboratories describing their research and teaching activities
6. Information available in the Department webpage.

All the meetings took place in a cordial and highly professional atmosphere in the Department main building. All faculty, students, and staff were extremely helpful, forthcoming and cooperative, and the overwhelming majority participated with enthusiasm in the evaluation process. The quality of documents and presentations was excellent; they were, for the most part, both informative and detailed.

The Committee would like to express its appreciation to the Department Head Prof. Christos Papadopoulos, the Dean of the School of Engineering Prof. Nikos Anyfantis, and Prof. George Labeas for their efforts to facilitate the work of the Committee.

II. The Internal Evaluation Procedure

The Internal Evaluation Report (IER) was prepared by the Department's internal evaluation unit (OMEA) and was available to the Committee prior to its visit. The Committee feels that the IER provided a candid and sincere assessment of the capabilities, strengths, and weaknesses of the Department.

Overall, the IER meets the objectives set forth by the HQAA guidelines; however the lack of systematic internal evaluation procedures in the Department (as also admitted in the IER itself) is apparent in the quality and completeness of the IER. In addition, the faculty evaluation metrics seems to be incomplete, missing important items such lists of "best paper" or "most downloaded paper" awards for papers published in archival journals or presented in international conferences; invited lectures to foreign academic institutions and research centres; incorporation of novel and innovative teaching methods in the classroom, etc. Finally, the inclusion in the IER of a complete list of short (1-2 pages maximum) of the curriculum vitae of all academic faculty members, along with a list of their most recent publications, would further improve the IER and enhance its transparency, especially for future evaluations.

III. General Comments

The Department was founded in 1967, originally as the Engineering School of the University of Patras. It has provided curricula in Mechanical Engineering on a five-year basis since 1972. In 1995, the Department was expanded and started offering courses in Aeronautics.

A Diploma degree is awarded after five years of studies and the successful accomplishment of a Diploma Thesis. At the post-graduate level, the Department offers programs leading to a Ph.D. degree in Mechanical Engineering and Aeronautics. The Department claims the equivalence of its Diploma to a Master's Degree. The Committee considers this claim to be justified by the depth of the education offered, curriculum structure, teaching methodology, academic staff qualifications and laboratory and teaching facilities.

The Department is structured in 4 Divisions as follows:

- Division of Design and Manufacturing Engineering
- Division of Energy, Aeronautics and Environment
- Division of Applied Mechanics, Technology of Materials and Biomechanics
- Division of Industrial Management

Research and teaching are organized under the following Laboratories:

- Laboratory of Machine Design
- Laboratory of Mechanisms and Machine Theory
- Laboratory for Manufacturing Systems and Automation
- Laboratory of Stochastic Mechanical Systems and Automation
- Laboratory of Manufacturing Processes
- Laboratory of Thermodynamics and Statistical Applications
- Laboratory of Fluid Mechanics and Applications
- Laboratory of Internal Combustion Engines
- Laboratory of Nuclear Technology
- Laboratory of Engineering
- Laboratory of Aerodynamic Design of Air-Vehicles
- Applied Mechanics Laboratory
- Laboratory of Technology and Strength of Materials
- Laboratory of Biomechanics and Biomedical Engineering
- Laboratory of Operations Research
- Laboratory of Industrial Management

Overall, the Committee was impressed by the level of competence of students and faculty, the quality and quantity of applied research output, the state-of-the-art facilities, and, especially, their superb "esprit des corps" despite the current adverse socio-economic situation.

A. Curriculum

General Comments

I. Undergraduate Curriculum

The mission of the Department, as set by its constitutional law (Β. Διάταγμα 399/28.06.1972 successively modified with Π. Διάταγμα 404/06.11.1995), is that of educating engineers, who can deal with:

- 1) The study, construction and supervision of mechanical installations in buildings and in industry.
- 2) The design and construction technologies of air and spatial crafts, airplane design, the analysis of airplane structures, airplane materials, aerodynamics and aircraft propulsion systems.

The unified diploma awarded by the Department has the following two specialisations:

- 1) Mechanical Engineer
- 2) Aeronautical Engineer

The above mission is implemented through an academic curriculum, which is articulated in semester courses spanning over a period of 10 academic semesters (5 years). The program is structured in a common 6-semester core program and four separate 4-semester specialisation programs (paths). Approximately half of the total amount of courses, depending on the specialization chosen, is compulsory, while the remaining courses can be chosen from a list of a rather wide range of optional topics offered by the Department. There are no pre-requisites or co-requisites. There is no freedom for a student, with some notable but rare exceptions, to choose (as part of the optional courses) from subjects offered by other departments of the University. In addition to traditional lectures and laboratory exercises, students are required to prepare:

- a. A Diploma Project (Σπουδαστική Εργασία), spanning one semester (usually the 7th). The requirement for such a project is unique to the Department.
- b. A Diploma Thesis (Διπλωματική Εργασία), spanning over the final two semesters. The Diploma Thesis is required for graduation by all Departments of the Engineering School and is a key element in the School's claim to a Master's degree equivalence of the offered Engineering Diploma degree.

A total of 42 core courses, 20 specialization courses plus the Diploma Project and the Diploma Thesis are required for graduation. A minimum of 296

credit points are required for the award of the Diploma. This corresponds to 58 courses, the Diploma Project and the Diploma Thesis. The Diploma Thesis alone accounts for 55 credits, while the Diploma Project accounts for an additional 30 credits. A mathematical formula determines the final grade by a weighted combination of the course¹ grades and the Diploma thesis grade. In the IER there is a comprehensive analysis of the curricula offered.

A professional/industrial summer training program (πρακτική άσκηση) has been implemented by the Department for the last 12 years. The program is optional and currently about 10% of the active students of the Department participate. Typically, the program lasts for two months and allows for limited financial support for the trainee. A well-defined procedure is followed for the selection and performance evaluation of the trainees.

The academic curriculum is, in broad lines, consistent with the legislated and stated objectives and the requirements/expectations of the Greek society.

II. Post-Graduate and Doctoral Curriculum

The Department offers two types of graduate studies:

1. Doctoral studies, leading to the award of a Doctoral (PhD) degree; this is the most important, in terms of number of students and resources, part of the post-graduate offering of the Department.
2. An interdisciplinary post-graduate (Διατμηματικό) program, on the *Science and Technology of Polymers*, offered since 2010, exclusively in Greek language, in collaboration with 4 other departments of the University; the program is fully funded by the Greek government.

The Department has approximately 200 post-graduate and doctoral students. Most of these students are supported by research funds, either by the Greek State or through externally funded research programs (i.e., EU collaborative projects), the rest being self-supported.

The student recruitment procedure is based on the resume of the applicant, possible publications, recommendation letters, and the results of an interview. Usually, the majority of applicants are accepted, as the number of available positions is larger than the number of applicants.

Doctoral students follow four courses selected from a rather wide, pre-determined list, in consultation with an academic supervisor. Starting from the academic year 2008-2009, graduates of a four-year degree program can be accepted, but they need to register for an additional six undergraduate courses. This is a positive development, since it enhances inter-disciplinary training. All graduate courses are delivered in Greek.

¹ Only 58 out of a minimum of 62 courses taken contribute to the Diploma grade.

The academic progress of each doctoral student is followed by a 3-member advisory committee consisting of faculty members of the Department and/or from abroad.

Doctoral theses are defended in front of a 7-member examining committee consisting of faculty members of the Department, faculty from other related departments, or from abroad. The thesis committee evaluation is also based on the number of papers presented in international conferences and journals, with a minimum number of two journal papers required for graduation.

Observations and Recommendations

- 1) The inflexibility of the curriculum prevents students from taking courses from other Departments, which is an inhibiting factor for their intellectual growth, and which is necessary for research in interdisciplinary fields and emerging technologies. Consequently, the Committee recommends the offering of some *free electives*, including courses offered in other departments or across the University. Such courses would significantly broaden the options available to the students during the final two years of their studies, while allowing for the concentration of the Department's resources to its core competences. It could also lead to the avoidance of duplication of services, staff and infrastructure, and permit a more efficient University structure.
- 2) The curriculum, most probably for historical reasons, includes too many courses, compared to most US and European Universities. This may be appropriate for highly motivated, well-prepared students, but constitutes a rather excessive workload to the majority of the students, as reflected also in the statistics on the effective duration of studies (currently, only 13% of the incoming students graduate within 5 years while 34% graduates in 6 years and 19% in 7 years). Despite the particular needs of the Greek market, which requires broad skills rather than deep specialization, the Committee feels that there is ample room for a lighter curriculum. Faculty resources made available by such a course reduction could teach overpopulated courses by splitting them into parallel sections or in expanded post-graduate course offerings. The Department should thus put more effort to streamlining the curriculum, while, at the same time, maintain the strength of the program.
- 3) As pointed out in the IER, no systematic method is in place for monitoring and evaluating the adequacy of the curriculum and the overall effectiveness of the educational process. The Committee feels that a mechanism should be established for evaluating, revising and modernizing the curriculum to account for the rapidly evolving

mechanical and aeronautical engineering developments such as the emergence of new technical disciplines, tools, and methods.

- 4) The Committee commends the Department for its industrial undergraduate internship program, which is one of the strengths of its curriculum. The current number of participating students is, however, rather small. The Committee encourages the continuation and further expansion of this program. This is an important step for linking the future graduates of the Department to industry and promoting entrepreneurship, which can become a driving force to the development of the Greek economy.
- 5) The Committee feels that the large relative weight (85 out of 296 total credits) of the Diploma Project and the Diploma Thesis leads to grade inflation. This, along with the fact that all Diploma Projects/Theses receive almost perfect score (close to 10/10), is a poor academic practice, weakens the value of the thesis, and is not in the best interest of the students, as it reduces their incentive for hard work and excellence. The Committee recommends that the Diploma Theses/Projects be graded in accordance with the quality of the work performed.
- 6) The Committee is of the opinion that the lack of any pre-requisites in several classes is not beneficial for the smooth progression of students, and makes teaching more difficult and, potentially ineffectual. It is recommended that the undergraduate curriculum be restructured so that pre-requisites or co-requisites are introduced.
- 7) Another area that requires some re-thinking and improvement regards the offerings of graduate courses. Presently, any graduate curriculum changes require the approval of the Ministry of Education. Clearly, the University or the Department are best suited to approve course changes or new course offerings as needs develop.
- 8) Procedures for the continuous evaluation of PhD students need to be developed. Also, the research performed by the students in the various laboratories receives limited exposure within the Department. This can be improved by introducing informal research seminars in English, where doctoral students present their work to the faculty, research fellows, and doctoral students. This will also be a useful training experience for students in order to improve their presentation skills at international conferences.
- 9) The language of science is English. Research funding is increasingly coming from international sources (e.g., the European Union) and publication of research results appear, overwhelmingly, in the international literature in English. The Committee recommends the option of teaching PhD courses in either English or Greek, in order to

attract PhD candidates from a wider and potentially more qualified pool, including foreign students. For instance, during the academic year 2011-2012 there were 52 openings and only 31 applications were received. Similar numbers were observed in previous years. Such a step will also enable wider exposure of doctoral students to the international scientific community, increased interactions with international colleagues, and enable the teaching of some specialized courses by visiting distinguished scientist/engineers from abroad.

- 10) Recognizing existing strengths in several research areas of the Department, the Committee recommends that consideration be given to the development of a separate, focused, *advanced MS-level specialization degree* in specific areas of emerging technologies, compatible to the key core competencies of the Department, offered in English. This could also attract fee-paying foreign students. If successful, this could increase the international visibility of the Department and enhance its future development.

B. Teaching

General Comments

Undergraduate teaching in the Department aims at providing an in-depth and in-breadth education for producing well-rounded mechanical/aeronautical engineers, equipped to work on classical as well as more advanced/specialized (e.g., robotics) technologies. What contributes to this, in addition to the high quality and quantity of the courses taught, is hands-on work in the laboratories in the context of courses, and the Diploma projects and theses. Several students participate in European-wide competitions, through student-led team projects, such as the racing *Aeolus* cars (developing velocities up to 36km/hour), the solar vehicles *Hermes I* and *Hermes II* winning the *Young Aerospace Engineer 2009* award, the *Atlas II* airplane, being distinguished in the *Design-Build-Fly* pan-European competition, and also yearly participations of one-seat racing cars in the *Formula Student* competitions.

The teaching methods at the undergraduate level involve a mix of traditional lectures, exercise sections, and laboratory exercises. The students seem to appreciate the projects more, especially if they are motivated by exciting, real-life applications. The quality of the books and notes given to the students (for free) is very good. Homework is not given in most courses (a

very common situation in Greece), and attendance is not mandatory.

The Department has a significant number of well-equipped laboratories, as well as two Departmental computer laboratories. It was observed that technical staff support in these labs is limited, with their functions inevitably falling on doctoral students and research personnel. The computer facilities available to students appeared adequate and equipped with up to date software. However, some faculty members pointed to a student weakness in terms of programming skills and applied numerical methods.

The linking of research with teaching appears to be very good through the Diploma Project and Diploma Thesis, leveraging the research taking place in most laboratories. The Committee met three international students who, under the Marie Curie fellowship, will be based in one laboratory during their three-year fellowship. Also, under the Erasmus program a small number of Greek students travelled abroad, and a similarly small number of foreign ones visited the Department.

Overall, the Committee feels that the Department offers a very good education to a large number of students, preparing them well for the engineering profession.

Observations and Recommendations

- 1) The Committee was very pleased with the level of participation of students in several European-wide competitions. It is recommended that the efforts expended by the supervising faculty member or research staff be rewarded (perhaps in the form of teaching credits).
- 2) The Committee feels that the current number of students admitted to the Department, as mandated by the Greek State results in a rather high student/faculty ratio. This has adverse effects on the quality of education offered, particularly in laboratory courses. It is notable, however, that the majority of students expressed their appreciation that the faculty spends personal time with them, both regarding course office hours and projects of various types.
- 3) The examination system is fair, but the administration of the final examinations and the lab report grading process could be improved in order to reduce, or eliminate, academic dishonesty (apparently endemic in Greek higher education).
- 4) Excellence in teaching requires student feedback. Although the recent introduction of course evaluations is a good first step, the Committee recommends that: evaluations be compulsory in every course; the questionnaire may be simplified to include only key criteria about the

quality of the course, the quality of teaching, the method of delivery, the extent to which the student has benefited, etc.; most importantly, space should be provided in the questionnaire for student comments.

- 5) The Committee recommends the establishment of Departmental “Excellence in Teaching Awards” for faculty that includes input from the students. Such awards should recognize faculty members who excel in the classroom, enhance the student learning experience via innovative teaching methods, etc., and would also increase student engagement and classroom attendance.
- 6) Establishment of the concept of a faculty “student advisor” may be a way to help those students who fall behind in their studies. The student advisor is a faculty member who will guide these students through the first three years of their studies and to whom they can turn for advice.

C. Research

General Comments

The Department does not appear to have a formal policy towards research. Nonetheless, the Committee was able to confirm that research constitutes an important component of the activities of the academic staff; indeed, performance and productivity in research is the main criterion for promotion and tenure. Some research is also conducted at the undergraduate level mainly through the Diploma Thesis expected from every student. However, the main research effort is conducted by the members of the faculty individually or through the laboratories, through the post-graduate program, and by post-graduate researchers.

The Committee was not made aware of Departmental standards or mechanisms for continuous assessment of research, presumably because this is difficult, given the breadth of research activities that take place (breadth in technical disciplines, and between applied and more fundamental research). The research of each faculty is, however, evaluated at every promotion step.

Unquestionably, the research of many members of the faculty is both visible and recognized in Europe at large and, for several, in the wider international scientific community. This is evidenced by their publications in the international literature and the number of citations received, participation in and organization of international conferences, symposia, short courses, etc., and by awards and other recognitions received. Overall, the department is rated as very good in this area.

Observations and Recommendations

- 1) Because of the current economic crisis, at the present, University or Departmental support of research is mainly limited to a modest return of research overhead funds. This is clearly inadequate with adverse effects on many research activities, particularly those of the younger faculty at the beginning of their careers. For example, a small budget for travel to international conferences for younger faculty without research resources of their own should help them set their research careers in the right footing. When resources are available, start-up packages for beginning faculty should again help them get their research program off the ground, a task which, admittedly, is challenging in all systems and countries.
- 2) The main research infrastructure of the Department is its laboratory facilities distributed through its four divisions. The building facilities and laboratories were found to be in good condition and to have been well kept, which speaks well for the University and Department management. The laboratory equipment varied significantly in age and relevance to modern experimental science. Some inconsistencies in the allocation of space between labs was observed, apparently due to historical reasons. The Department should consider a more consistent space allocation strategy, which takes into account the current educational and research needs, as well as the performance of the various laboratories in attracting post-graduate students and external research funds.
- 3) The technical support available for research in the Department appeared inadequate and unevenly distributed. Clearly, this area requires enhancement, which can be achieved with additional resources/positions but also by some reorganization. The latter might involve bringing all technicians under departmental management with the aim of providing support to the whole department including all its labs. For example, the following technical disciplines could be supported by one technician each: electronic, mechanical, information technology, etc.
- 4) In terms of *Scientific Publications*, the Committee found that, overall, the number of publications from the Department, as a whole, is healthy. This includes publications in the archival international literature as well as in the proceedings of international meetings. Publication numbers per Division and Laboratory were given, but it was not possible to establish the publication productivity of each individual faculty. The Committee was made aware, however, that there are faculty members who are not particularly productive in research, concentrating more in teaching. In some respects, this is not surprising given the lack of incentives for members of the faculty at the highest level to remain engaged and productive in research.

- 5) In terms of *Research Projects*, it was clear from the presentations given to the Committee that, as a whole, the faculty of the Department has been able to garner a very healthy number of sponsored research projects. An average funding level of about 4.7M EUR per year was reported for approximately the last five years, which is impressive, especially considering the economic crisis of the county, Europe and the world as a whole over this period. The projects presented tended to have a strong connection to engineering applications.
- 4) In terms of *Research Collaborations*, the Committee observed that most research is conducted under the umbrellas of Department laboratories that cover specific technical disciplines. Cooperation among the members of each lab is broad, usually involving several multi-investigator projects. At least two disciplines appear to be covered by two labs, each causing some duplication in equipment, facilities, and use of space. Less cooperation was reported to take place between such sister labs. Although this is probably rooted in the history of the Department, more coordination and cooperation between labs with technical overlap should improve efficiency, reduce duplication of costly equipment, and strengthen research proposals.
- 5) A number of cooperative research efforts with European academic and industrial researchers were reported. These are positive relationships that broaden the outlook of local researchers, increase their visibility in the scientific community, and generally improve all concerned. They are applauded and should be encouraged. During its visit, the Committee was introduced to three international Marie Curie doctoral students in bioengineering who are spending three years in the Department. This was a welcome surprise that points to the international reach of this research program and the faculty involved.
- 6) Presently, the main local reward for a high level of research activity is the partial salary enhancement that some research projects provide to the faculty. An additional benefit is the opportunity to travel to international conferences using research funds. The Department could benefit by the implementation of several measures that recognize achievements in research:
- a. Introduce department annual research prizes, e.g., a “best Diploma thesis award,” “best PhD thesis award,” a “best paper award,” a “best researcher award.” These could receive a small monetary award but, most importantly, also provide a widely communicated recognition, e.g., departmental website; recognition at a special ceremony of the department; publications in the national press, etc. Funds for such activities can be sought from industries associated with the department, and from alumni

of the Department. Obviously, local recognition should be given to *all* external awards and other such personal or group achievements.

- b. Introduce a regular research seminar to the Department where visitors, but also local researchers, can present their work and have it discussed and scrutinized by their colleagues. Again, some external support can be sought for such an endeavor.
 - c. Encourage travel and participation in international conferences, etc. Again, some support from the Department especially for younger researchers, or in the form of awards recognizing high achievement in research can be helpful here.
- 7) Some *Patents* have been granted to faculty of the Department, which is a very positive development, and should be further encouraged. The required support framework for assisting in the patent application process, at University level, should be strengthened.

D. All Other Services

General Comments

The administrative services of the university seem to be competent, but suffer from the limited number of staff available. Recently, this has become a more urgent issue due to the enforced reduction in personnel. The enrolment system is partly electronic, and there seems to be sufficient protection against access to personal student data against hacking attacks. A new electronic-based system («Ψηφιακό Άλμα») is currently underway to simplify the administrative bureaucratic procedures. However, the system is not fully operational yet. The distribution of personnel does not seem to follow an established pattern, and it is not rare to see inconsistencies between hired employee qualifications and the posted job description.

The Department and the University at large has adequate infrastructure. The University resides in a large campus having adequate transportation services. The facilities include a sporting center, a modern library and an impressive conference center.

Observations and Recommendations

- 1) The laboratory spaces and classrooms are, in general, adequate; yet the

very large number of incoming students may be a challenge, should all of them decide to attend. Research facilities are also sufficient, overall, but are stretched to their limits. The recent annexing of the former *General Division* academic units is an additional challenge.

- 2) The academic records and the registration of students are presently handled at the Department level. This adds unnecessary duplication of staff duties and inflates the bureaucratic process. The committee feels that a centralized University wide *Office of Student Affairs* that handles student enrolment, student records, etc. would streamline record keeping and reduce staffing pressures. Of course, a fully electronic record keeping would simplify these tasks and reduce bureaucracy.
- 3) There are few opportunities for entry-level technical and administrative staff for professional development. Consequently, many remain stagnant and their morale is low. The Committee recommends that the Department fosters “life-long education” for its administrative and technical staff through periodic seminars and professional training sessions in new technologies and methods.

Collaboration with social, cultural and production organizations

The Department is actively involved with the local community at several levels. For example, it is helping with the education of local schoolchildren through the “school goes to University” program, donation of old computers to local schools, offering mid-career development courses to local professionals, etc.

On matters of public interest that fall under the expertise of the members of the Department, the Committee recommends that the Department should adopt a more proactive strategy encouraging the academic staff to express their scientific opinion. This will create synergies with the local society and enhance the prestige and visibility of the Department.

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

Strategic Planning

As mentioned in the IER, a vision of the department for the next 10-20 years is absent and needs to be developed, so as to set concrete and achievable targets for the future. Moreover, the Department’s mission, as set by its constitutional law (B. Διάταγμα 399/28.06.1972, modified with Π. Διάταγμα

404/06.11.1995), is now out-dated, and especially in what concerns the specialisation in Mechanical Engineering. It should be revised, in order to reflect the recent technological evolution and societal changes.

The Committee suggests that the Engineering School form an *Advisory Board* that can assist in defining the strategic goals of the School, its needs, and its future directions. Such an Advisory Board could consist of prominent external scientists and engineers, industrial affiliates, former students, and members of the faculty.

It is also suggested that the Department organize periodically (e.g., every 2-3 years) one-day “faculty retreats” in order to self-evaluate its current state, reflect on its strengths and weaknesses, and strategize for the future.

Potential Inhibiting Factors

There are numerous inhibiting factors, which, if properly addressed, would contribute towards the improvement of the Department, enhance its national and international visibility, increase its efficiency, and allow it to compete in the global educational landscape. A non-exhaustive list of such inhibiting factors includes:

- The rather large number of incoming students, which stretches the Department resources and leads to lower quality of teaching, especially in the case of lab projects and the faculty ability to advise students.
- The inability to continue attracting and retaining prominent young faculty from abroad owing to the current low salaries and the absence of generous start-up packages.
- Many existing regulations are obsolete and create bureaucratic obstacles hindering change. Notable examples include the rigidity of the curriculum, the paucity of inter-departmental course selection, etc. To its credit, the faculty has tried, over the years, to work around existing regulations in order to provide a high-quality engineering education, but several of these regulations (many of them instituted several decades ago) have to be re-evaluated to determine their relevance to a University of the 21st century.
- Presently, the teaching-load is rigidly fixed by the Ministry of Education. The requirement of teaching a fixed number of courses per year per faculty that does not allow teaching load reduction to account for graduate student advising and research activities. The work-load of a research faculty must include some consideration of research activities, such as number of post-graduate students supervised, etc. Some flexibility can be added to the system to allow Department Chairs to use their discretion to

relieve active researchers, adding recognition of, completion and reward for research activities.

- The frequent closing of the University by protesting students (often for non-academic matter) is not conducive to a learning environment.
- There is no a priori maximum number of times a student can take the final exam to pass a class. Consequently, many students do not attend classes and show up repeatedly to take exams, concerned more about a professional degree qualification rather than true subject matter learning. This is a common problem in Greek higher education that risks transforming Greek Universities to “Examination Centers.”
- The non-existence of joint faculty appointments with/across other departments, which is necessary for cutting-edge research, especially in interdisciplinary areas (e.g. bioengineering).
- The absence of generous start-up packages and travel funds for the young faculty hinders and delays individual faculty development; such funds could be made available through a better allocation of research funds handled by the University Research Committee or could be self-raised through the creation of English taught courses as suggested earlier in this report.
- The inability of students to take courses from other departments, which is crucial for emerging and interdisciplinary areas.
- The number (16) of the laboratories in the Department is deemed excessive, and, to a great extent, reflects the ambitions of individual faculty rather than the actual educational or research needs of the Department. There is great variability in terms of installations, equipment, personnel, allocated space and external funding. Some laboratories excel in facilities and equipment, while others consist of little more than benches and desktop computers. Most importantly, the current structure of the Department according to Laboratories is an obstacle for individual faculty growth and independence, especially for younger faculty.
- There appears to be very scarce collaboration and sharing of facilities between the Department’s laboratories (in particular among the larger ones), inevitably leading to a duplication of equipment (e.g., wind-tunnels, universal testing machines) and resources.
- The lack of proper systematic evaluation of teaching and other educational activities results in insufficient recognition of teaching excellence in faculty promotions. This is an important issue that needs to be addressed.

F. Final Conclusions and Recommendations of the EEC

General Remarks and Major Recommendations

The Department's undergraduate and doctoral programs are well established, and have been running effectively for many years, achieving the intended scope of producing qualified mechanical and aeronautical engineers. The Department, despite the existing non-conducive legal framework, has adapted to the societal and technological evolution reasonably well, both in terms of structure, curriculum offerings and research content. This is due, to a great extent, to the quality and perseverance of the academic and support staff.

The Committee has identified several areas where improvements are possible; its main recommendations are outlined below:

1. *Reduction/Consolidation of Courses Offered:* The number of courses offered and topics covered in the undergraduate curriculum are too many. Re-evaluate and restructure the undergraduate curriculum in light of recent technological trends and market needs.
2. *Course Pre-requisites:* Introduce pre-requisites or co-requisites with the aim of ensuring a smoother progression in the educational experience of students.
3. *Interdepartmental Course Registration:* Establish free-electives so as to enable wider interactions between scientific disciplines, which in today's interdisciplinary scientific scene is essential.
4. *Introduction of English in Post-graduate Classes:* Allow the possibility of teaching post-graduate classes in English in order to provide wider exposure of doctoral students to the international scientific community, increase interactions with international colleagues, enable distinguished visitors to part take in teaching, etc.
5. *Offer MS Degrees in Specialized Courses:* In select areas of strength of the Department, offer 1-2 year MS degrees ("Masters of Advanced Study"). The courses are to be taught in English in order to attract fee-paying foreign students and increase the international footprint and impact of the Department.
6. *Teaching Evaluations:* Establish compulsory teaching evaluations in all courses; simplify the questionnaire to include only key criteria about the quality of the course, the quality of teaching, the method of delivery, the extent to which the student has benefited, etc.; allow extra space in the questionnaire for student comments.

7. *Reward Excellence in Teaching:* Establish Departmental “Excellence in Teaching Awards” to faculty that include input from the students to recognize faculty members who excel in the classroom, enhance the student learning experience via innovative teaching methods, etc. Such awards may very well also increase student attendance.
8. *Performance-Based Faculty Evaluation:* Establish a more thorough and transparent system (along with suitable metrics) for evaluating annually the performance of each faculty member. Within the resources of the Department, reward faculty members with outstanding research, teaching, or service records with awards, prizes and increased visibility. Although the Greek system does not provide for performance-based annual salary increases, local action can motivate faculty and promote excellence.
9. *Faculty Diversity:* Presently, only 4 out of 44 full-time faculty members are female (none at the Full Professor level) and 24 out of 44 members on the faculty are graduates of the University of Patras. Although the faculty composition is an outgrowth of the relatively young age of the Department as well as policies and conditions at the national level, future hires should seek diversification along these two dimensions, in order to ensure the intellectual broadening and growth of the Department as a whole. Encouraging new PhDs to seek positions elsewhere should help in this regard.
10. *Visiting Professorship:* Institute a Visiting Professorship to entice well-established foreign faculty to spend sabbatical time at the University of Patras. The benefits from such bridge-building visits in internationalizing the Department, its student and faculty can be significant.
11. *Commercialization of Technology:* Despite the high-quality applied research conducted at the Department, the commercialization of developed technology (via start-ups, technology licensing, etc.) remains low. The University should provide incentives to promote entrepreneurship among its faculty and students.
12. *Centralization of Departmental Technical Staff:* Consider bringing all technicians under departmental management with the aim of providing support to the whole department including all its labs. For example, technical disciplines such as electronic, mechanical, information technology, etc., could be supported by one or two technicians each.
13. *University-wide Registrar's Office:* Reduce the duplication of the administrative processes regarding student registration and grade-keeping among the many Schools and Departments of the University by establishing a centralized University-wide Registrar's Office or Office of Student Affairs that would handle all student enrolments, student records, etc.

14. *Formation of an Advisory Board:* Form an Advisory Board that can assist in defining the strategic goals of the School, its needs, and its future directions. Such a Board could consist of prominent external scientists and engineers, industrial affiliates, former students, and members of the faculty.
15. *Reconnecting with the Alumni:* Establish an office for student placement and alumni relations. An annual leaflet on departmental highlights can help keep alumni informed and connected. Consider adding a development component to this effort to raise funds for Departmental awards and recognitions.

Finally, the upcoming 50th anniversary of the University of Patras in 2014 should be highlighted and celebrated. It serves as an excellent opportunity for the University and the Department to showcase its achievements. To this effect, the University should invite internationally prominent scientists and engineers to visit and make them aware of the School and its achievements.

The Members of the Committee

Name and Surname	Signature
1. _____ _____	
2. _____ _____	
3. _____ _____	
4. _____ _____	
5. _____ _____	