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Engineering Research and Resources The American University of Beirut

As a member of the University of Southern California Science & Engineering Library faculty, I was granted a Sabbatical Leave in 2006 to study the engineering researchers' resources at the American University in Beirut, Lebanon (AUB). My sabbatical report was well received by my colleagues at USC and elsewhere motivating me to enhance it and share it with you. The purpose of this paper is to reflect upon the history of an academic institution that sustained excellence in teaching and research for almost one and a half centuries during which the institution celebrated the elation of success, but also endured many tragic events. My hope is to encourage you, the engineering faculty, to get involved in international engineering education programs in response to the global challenges that the AUB and other institutions face and experience throughout the world.

A Historical Perspective --

In 1862, what is now Lebanon was part of the Ottoman Empire, which then ruled most of the Middle East. American missionaries in the region had built a Syrian Protestant College under the direction of the American Board Commissioners for Foreign Missions. They asked Dr. Daniel Bliss to withdraw from his evangelistic work to found a college of higher learning in Beirut Lebanon with American educational principles. Dr. Bliss traveled to the United States first to solicit funds for this new enterprise, and after a short time he had raised more than \$100,000.00. During the inflationary Civil War era this money was not enough. On his way back, he stopped in England and raised a sterling fund enough to start the operations leaving the dollars in an endowment to appreciate.

In 1863, while Dr. Bliss was still raising money for the new school, the State of New York granted a charter under the name of the Syrian Protestant College, which later moved and was named The American University in Beirut, Lebanon. The AUB is a private, independent non-sectarian, co-educational institution of higher education. A private, autonomous Board of Trustees administers it. The AUB bases its educational perspective and methods and its academic organization on the American model of higher education. It is a teaching-centered research university convinced that excellence in teaching and research go hand-in-hand. English is the language of the curriculum. The University is situated on 73 acres of terraced campus overlooking the beautiful blue Mediterranean Sea with vistas of the majestic snow-capped Lebanon mountain ranges home of the Biblical Cedars of Lebanon. Bliss Street separates the campus from the city. The campus is accessed through Main Gate bordering Bliss St., Medical Gate, connecting the main campus to the Medical campus, and Sea Gate at the foot of the hill and across the street from the Mediterranean shores.

2007 marked the 141st anniversary of the AUB. During this period the institution has awarded more than 70,000 degrees and diplomas to students from around the globe.

Through the decades, the AUB has been the beacon that shed light through education across the Mediterranean and beyond to the Middle East, North Africa, and Europe.

For the last 30 years, endemic political crises in the regions have shaken the AUB. Riots, assassinations, bombs, and social and political unrests have made it more difficult to accomplish the mission set forth almost one and a half centuries ago. Nevertheless, the AUB perseveres with remarkable success, given the circumstances. The mission statement - emphasizing scholarship that enables students to think for themselves, stresses high academic standards, and promotes high principles of character. The aim is to produce men and women who not only are technically competent in their professional fields, but also are lifelong learners who have developed breadth of vision, a sense of civic and moral responsibility, and a devotion to the fundamental values of human life. Strategic goals continue to be set on a long-term basis - goals that focus on excellence in education, high quality research, leadership and integrity, commitment to service and continual quality improvement.

Here are some areas that the AUB is focusing on.

Excellence in Teaching and Research In Engineering --

Recognizing the need for institutional quality assurance, the Faculty of Engineering and Architecture formed a Total Quality Management (TQM) to enhance the academic programs in teaching and research. As indicated in the University's website, the goal is *"To promote a high-quality faculty and student research environment, with centers of excellence in areas of comparative advantage and regional and international need"*.

The AUB expects its faculty to develop a research profile of high academic quality. Faculty members are evaluated by their contributions through publication in internationally recognized peer-reviewed journals and academic presses. It continues to expand and enhance the research facilities, classrooms, computer labs and libraries. However, the continuous civil and political unrest, from 1976 and to the present has weakened the fragile infrastructure of the country. The "Brain Drain" caused by the departure of the highly educated young people who fled the country in search of better opportunities, has been a huge negative factor in the advancement of the academic teaching and research programs at AUB. Among the casualties has been the discontinuation of all the post-graduate and Ph.D. programs, mainly those in the sciences and engineering.

But the research facilities are what keep the heartbeat of the University strong and alive as these continue to grow with hopes that stability will return. These hopes and goals remain elusive, but despite the chaos, research progress continues. Here are some examples of the research activities in science and engineering disciplines.

- --The Ray Irani/Oxy Engineering Complex is now completed. It gives the engineering students the chance to do research with hands-on-experience in high-tech interactive laboratory environment. Dr. Irani, the Director and CEO of the Occidental Petroleum company in Los Angeles, is a notable AUB alumnus and serves on the Board of Trustees.

- --The Consolidated Contractors International Company (CCC) Scientific Research Building is located close to the Engineering & Architecture Library. It accommodates a wide range of laboratory needs in the areas of engineering, computer science, and basic scientific research materials.
- --The AUB's Energy Research Group, based in the faculty of Engineering and Architecture, has collaborated with the Jordan University of Science and Technology, the Palestine Polytechnic University and the Birzeit University to develop renewable energy initiatives and technology to enhance energy efficiency and to contribute to environmental sustainability efforts in the Middle East. Using the AUB's Climate Chambers, researchers are designing tools to reduce energy consumption.
- --The Center for Advanced Mathematical Sciences (CAMS) is the leading institute for research in the field in pure and applied mathematics in the Arab world – the birthplace of mathematics. The Institute promotes interdisciplinary research in physics, chemistry, the natural sciences, engineering, computer science, economics and business. The Center also sponsors the X Lecture Series. To mark its 10th anniversary, the world-renowned Lebanese mathematician Sir Michael Atiyah was invited to lecture on the Role of Mathematics in Modernity –“Mathematics and Society in the Twenty-First Century”.
- --The Electrical and Computer Engineering (ECE) Center is where faculty and students are conducting research on a range of topics including embedded systems, signal processing with VLSI implementations, wireless communications, network security, and antenna arrays.
- --The Biomedical Engineering Program, in collaboration with the chemical and biomedical research initiatives, is flourishing under the auspices of the Faculty of the School of Medicine and the Medical Center.
- --IBSAR stands for the Initiative of Biodiversity Studies in Arid Regions. It is an interdisciplinary research program collaboration between the chemistry, chemical engineering, and Agriculture departments. The aim is to explore and to develop related economic opportunities through the study and research of biotechnology approaches that support biodiversity and the environmental stability in the region. Working under the IBSAR umbrella, AUB scholars are investigating bioactivities from wild plants in Lebanon and the region, looking at possible commercial, medical, agricultural, environmental, and industrial uses of wild plants, which thrive in the valleys and the foothills of Lebanon. In doing so, the researchers are developing culturally sensitive concepts for biodiversity conservation. The Center is currently busy trying to reseed the hills and mountains of Lebanon that were set on fire during the summer and fall of 2007. This was just about the same time that California was burning. Sadly, the fires in Lebanon were set on purpose by politically motivated arsonists.

- --The Water Resources Center is involved in efforts to rationalize the planning and management of water resources and to develop strategies for the optimal usage of this vital resource. This is a critically important topic for the region, which has not effectively been able to succeed in harnessing the water from the winter rainy season and the snow melts of the spring in reservoirs for irrigation during the arid, dry summer and fall seasons. For this, the Center, which is a forum for information exchange and regional cooperation with the department of Environmental Engineering, has conducted a coastal zone management and development study to define opportunities for socio-economic growth through environmental protection.
- --The Reaction Wall-Strong Floor system is a newly constructed test facility in the department of Civil/Environmental Engineering. This system is being used to assess the vulnerability of building structures and other facilities to seismic activities in the region. This research fosters regional and international cooperation in areas where earthquakes often occur and where earthquake engineers are needed.

Other, non-engineering or science centers include, but are not limited to the following: The Center for Behavioral Research (CBR) and The Center for American Studies and Research (CASAR), which is the AUB's newest center. CASAR was established to encourage efforts to increase the knowledge and understanding of the United States in the Middle East. Other research topics include those dealing with current and timely research in political sciences, public policy, international affairs, history, business, languages and the arts and humanities.

Funding for these research centers comes from many different sources on the regional, national, and international levels. The campaigns seek funding from federal grants, foundations, businesses, corporations, and personal contributions. On the average, the AUB receives close to \$10 million in grants and donations annually. These funds go toward research facilities for equipment upgrades, and for endowments.

The AUB University Libraries. Academic support for the researchers and resources comes from the University Libraries, whose Mission Statement mirrors that of the University as quoted below are excerpts from their website and publications.

“The University Libraries embrace the mission of the University is supporting excellence in education and research and in serving the peoples of the Middle East and beyond. The libraries select, organize, maintain, preserve, and provide access to resources in all formats necessary to support the educational mission of AUB. The libraries teach the effective usage and the critical evaluation of information resources and capitalize on innovative technologies to foster intellectual growth. The University Libraries partner with all schools, faculties, and research institutes in the University and respond to users’ changing needs by continual evaluation of user expectations and by promotion of collections and services to meet the needs and challenges of the digital and electronic age. The Libraries serve primarily the students, faculty, administration, staff, and alumni of the University. They also engage and interact with broader communities, where possible, given their material and human resources.”-

The University Libraries comprise the following:

- --The Jafet Memorial Library is the Central Library and has two branches: 1) The Engineering and Architecture Library and 2) The Science and Agriculture Library, which has an annex at the AREC (Agriculture Research and Education Center). The Jafet Memorial Library houses the arts, humanities, mathematics, computer sciences, geology and social sciences collections. Unfortunately, the book stacks are still closed for users direct access, a practice that deters browsing and finding information through serendipity.
- --The Engineering and Architecture Library houses the engineering, computer engineering, and architecture collections. It has recently been relocated to a larger space in the Bechtel Engineering Building allowing for more computer labs and study spaces.
- --The Science and Agriculture Library houses the biology, chemistry, physics, general sciences, agriculture and food science collections. It is located in the Agriculture Building on the lower level of the terraced campus. The AREC Annex is located at the AUB Farm in the Bekaa Valley, a plateau between the eastern and western mountain ranges. Because of earlier warfare and bombing activities this valley is often a minefield full of grenades and explosives. The book stacks in these branch libraries are open to the public for quick and easy self-access and for browsing.
- --The Saab Medical Library functions independently from the Central Library System. The SML Library Director, Hilda Nassar, reports directly to the Dean of the Faculty of Medicine and to the Medical School administration for funding. The Biomedical Engineering faculty, students and research activities are under the auspices of the Medical School. The University Hospital is the major trauma center for the region. Therefore, the Medical School and the Medical Library must remain open at all times even under the heaviest bombings and political unrest. When I asked Mrs. Nassar how they function when the power is out, her answer was: “Well, you see, we have cars, but no where to go, so we take the batteries out, bring them to work and use them for makeshift mini generators. By doing so, we save the power of the main generator for critical use in the OR”. That is what being “resourceful” means.

The University Libraries collections contain a sizable number of microforms, audiotapes, photographs, maps, manuscripts, and very rare materials. They are the main research facilities for the University, for Lebanon and for the region. Plans are underway to enhance the collections and the facilities, with a focus on major additions to the electronic resources.

The “Faculty Subject Specialists – PhD Programs” were launched in the summer of 2006. The aim of this project was to enrich the library collections by acquiring for the researchers resources that equal or surpass those that are available in model American universities that the AUB emulates. To do so, funding for acquisitions was increased to

purchase over 18,500 new titles in print and digital formats. Most of these are monographic series, serials subscriptions, and/or encyclopedias in electronic format.

The E-Resources Committee examined 16 new electronic resources benchmarked with Ph.D. programs at model universities. In 2007, the Serials Department acquired ten new databases, including the following highly recommended and coveted Elsevier Science Direct, the Blackwell Synergy, and SpringerLink/Kluwer packages for a total additional expenditure of \$150,000.00. Databases that many American researchers and others in the free world are accustomed to accessing, such as Web of Knowledge; IEEE Xplore; ACM proceedings; Compendex, and others, are all available to the AUB researchers. These databases are affordable because they benefit from better deals with the vendors due to the smaller number of researchers since the cost of these databases is generally calculated based on the number of users in an institution who will access them.

As with many American universities, the trend is to switch from print to digital, full-text online journals in many disciplines, especially in sciences, engineering and technology. Bargain hunting through the different vendors is an on-going effort. By comparing prices from different vendors for the best deals, the AUB Libraries have been able to save money and enrich their collections. Being the largest and the strongest academic institution in Lebanon, the AUB libraries do not benefit from interlibrary loans. They are often on the giving end of the spectrum.

Overall, the library collections are focused on supporting the curriculum and the research initiatives. There are no frills. As commonly practiced in institutions in the US, the teaching faculty are involved through a liaison system. Working with the librarians, collaborative and sensible decisions are reached for the acquisitions of library materials. Usually the chairs of academic departments appoint the liaisons to the respective librarian subject selectors. Some of these faculty members also serve on the Library Committee and thus create a continuum of interest and input. The AUB libraries do not have “approval plans” and no shelf-ready systems for acquired books. Budgets are allocated each year by the head Collection Development Librarian, in collaboration with the Head Librarian and the chairs of the academic departments.

In the 2006-2007 academic year, the allocation for library materials for both sciences and engineering amounted to about \$3 million dollars. Of that total, about one third was spent on monographic print materials and print journals. Two thirds were spent on e-journals and online databases in the sciences and engineering.

Enrollment varies each year between 5 and 7 thousand students who come from 40 different countries. Applications decrease or increase depending on the political climate in the country and in the region. Tuition is approximately \$14k-16k per year. About \$10 million are dispersed each year for financial aid and scholarships. A large proportion of this comes from the US. A large number of donations come from alumni, corporate sponsors, and foundations.

Khaled Noubani, the Engineering Librarian, just graduated with a master's degree in Library & Information Science from Indiana University. Upon his return to AUB this past summer, he appealed for additional funding in support of resuming the Ph.D. program in certain engineering areas. In a recent email communiqué, Mr. Noubani transmitted to me the following information regarding the new Ph.D. programs, which have been resumed:

**Ph. D. in Civil Engineering
Ph.D. in Environmental & Water Resources Engineering
Ph.D. in Electrical Engineering & Computer Engineering
Ph.D. in Mechanical Engineering**

Even though the total number of students enrolled in these programs is fairly small, new faculty members have joined the Civil Engineering, the Electrical & Computer Engineering, and the Mechanical Engineering departments. Thus, there are currently 77 engineering faculty, 27 of which are part-time. There are 1,450 students in all the engineering disciplines, and about 12 new graduate students embarking upon a Ph.D.

To enhance the research resources for these programs, an additional \$100,000 has been spent on new research resources to enhance the library's collections, including the Knovel Engineering Reference Library and the ASTM standards were added. More computers for online access, more space for printed materials and extended hours of service made it necessary for the Engineering and Architecture Library to move to a new location in Bechtel Hall, the Engineering Department building. Construction of the Irani Building has been completed creating several labs for all engineering disciplines.

I attended commencement during my stay. At AUB, graduation also means adding to the number of the AUB Alumni who now number close to 50,000 worldwide. They have a special affinity with and an unwavering support to their alma mater. They are very successful and have attained high positions in almost every field: engineering; government; science; economics; business; mathematics, and especially in medicine. Among the living notables in science and engineering are: Dr. Charles Elachi, the current director of JPL; Dr. Ray Irani, the present Director and CEO of Occidental Petroleum; Dr. Taha Mikati, engineer, investor and billionaire founder of Investcom; and Nabil Nassar, an engineer and senior partner in a larger architecture firm. Sir Michael Atiyah, the famous knighted mathematician, is another notable alumnus in whose honor the AUB Mathematics Institute was established and named. Numerous distinguished faculty and academicians who have attained high ranks at the very elite universities worldwide in the UK, the US, and elsewhere, boast of being the products of a strong academic beginning at the AUB.

Unfortunately, many of these distinguished alumni live elsewhere in the world, in countries that are fortunate to reap the benefits of their contributions to society. This exodus leaves Lebanon with an acute "Brain Drain" syndrome.

The roots of the Brain Drain are clear: despite heroic perseverance and dedication, the AUB remains under siege, a hostage to the unsettled politics of Lebanon and the region of which it is a part.

With the increasing reliance on electronic resources, what happens when the power goes off – as it often does – and access to the resources by the researchers is not possible? This is when endurance, resilience and commitment prevail. This is when the determination and the will to succeed overcome the fear and the disappointment. Events that took place in the summer of 2006 and continue are enough reasons for the closure of any other institution under similar circumstances.

The bombs first hit the lighthouse across the street from the campus. The University endured and, after a few weeks of closure, reopened for the fall semester. Planning resumed for the rest of the academic year and for another AUB graduation. During bombing and shootings in the city streets adjacent to the campus, the students opt to study in windowless bathrooms and basements using the flickers of candlelight for illumination to avoid the risk of getting hit. They have gotten accustomed to interruptions. They pick up the pieces and go on. When the University President was assassinated on campus, and when their administration building got bombed, their bravery and determination just went up to the second level. Their resolve is strong as they look forward to another graduation, an event that carries with it a much greater satisfaction and significance. It carries with it hope and freedom for a future never imagined by the typical student graduate elsewhere. Inconveniences, power outages and other difficulties are tolerated as they, with resilience, look forward to a better life ahead.

“The University seems to have a penchant for anniversaries in the midst of war”, wrote AUB’s President Stephen B. L. Penrose, Jr., on the occasion of AUB’s 75th anniversary during World War II in 1941. In 2006 & 2007, the latest crises hovered over like dark clouds as the University celebrated its 141st anniversary. Lebanon and the AUB have survived occupation by the Ottoman Empire, the French Mandate, and the Syrian occupation, and they will survive the current crisis. Throughout these occupations and conflicts, neither one came out unscathed. But, just like the phoenix, the AUB will continue to rise from the ashes and will continue to be the beacon for civilization and enlightenment just as the lighthouse, a landmark across from Sea Gate, is a beacon of light to the ships coming to a safe harbor.

I hope that this brief history of a giant institution will encourage you, the engineering faculty and researcher, to get involved in international engineering education and respond to the challenges. You may consider teaching distant education classes, take a sabbatical abroad and spend a semester there, attend a conference, or just lend your support in any way that you can. Your contributions will be greatly appreciated.

Thank you for your attention.

Notes and References

The AUB website – <http://www.aub.edu.lb/>

Libraries –

Jafet University Library

Engineering and Architecture Library

Saab Medical Library

Engineering Information at the AUB libraries – <http://webfea-lb.fea.aub.edu.lb/fea>

The AUB archives online – <http://www.aub.edu.lb/news/archive/preview>

Wikipedia, the free encyclopedia –

http://en.wikipedia.org/wiki/American_University_of_Beirut

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Personal interviews, email communications, and telephone conversations with--

Dr. Helen Bikhazi, Head University Librarian

Mr. Khaled Noubani, Engineering & Architecture Library

Ms. Hala Sayegh, Acquisitions Department, Jafet Library

Mrs. Samira Rafidi-Meghdessian, Reference/Instruction Librarian, Jafet Library

Ms. Olga Ayoub, Acquisition Serials Librarian

