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A Career in Capacity Building

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Capacity building, as it is now understood, has been a life-long passion for the author. He has built capacity to practice engineering in courses for his students, has developed the capacities of the several academic units and institutions that he has worked for, and has enhanced the capacities of several professional societies to serve the engineering profession. His current activity is directly aimed at building the technical capacity of developing countries to enable them to join the competitive global economy.

INTRODUCTION

The author was born and raised in western Pennsylvania, in the USA. His family was blue-collar, and he was born during the latter years of the Great Depression in the USA. He was the first member of his family to complete a college education, with a BS in Civil Engineering from Carnegie Institute of Technology.

Initially, the author worked as a consulting engineer for a small Pittsburgh engineering firm, but he was soon attracted back to graduate study by a fellowship from the National Defense Education Act – the response of the US government to the challenge posed by the launching of Sputnik by the Soviet Union. The publication of his doctoral theses, *Grain Size and Loading Rate Effects on Steel*, was awarded the Collingwood Prize by the American Society of Civil Engineers [1].

After earning a doctorate at Carnegie, he chose an academic path. Over the years, the author dedicated his career to engineering education, then education more broadly, as he rose through academic ranks. In parallel to his employment in academia, he was active in volunteer work in the engineering profession – an activism that continues to this date.

ACADEMIC POSITIONS

The author began his academic career as an assistant and associate professor in the Civil Engineering Department at Massachusetts Institute of Technology. He developed several new courses during his eight years there, in the structural materials area, and conducted research in his technical specialty areas. His first effort at what is now known as capacity building was involvement in the InterAmerican Program in Civil Engineering, which was an MIT programme funded by the Ford Foundation and the US Agency for International Development, and was aimed at upgrading the education and research activities of selected universities in Latin America. He collaborated with universities in Chile, Argentina and Brazil – with heaviest involvement with the University of Chile in Santiago. The papers titled *Substructure Formation in Cyclicly Loaded Metals* and *The Formation of Cell Structures in Fatigued Iron Crystals* resulted from that collaborative effort [2][3].

The author also undertook extensive research in fibre-reinforced metals, with the paper *Fractography on Aluminum-Boron Composites* being typical of that effort [4]. In addition, he conducted funded research projects for the National Aerospace and Space Administration (NASA) on the utilisation of NASA technologies in earthbound systems methodology and urban construction.

The MIT InterAmerican Program in Civil Engineering was the opening wedge in what has become for the author a career-long involvement in the international aspects of engineering education and capacity building. During his eight years at MIT, he travelled extensively to Latin America to interact with research collaborators there, and hosted many Latin American researchers in his laboratories in the USA.

The author's first step up the academic administrative ladder was his move to the Ohio State University to serve as its department chairman. The timing of that move was such that his department needed to significantly expand its environmental engineering activities, and the author was instrumental in building up that area through the addition of new faculty members, more students and expanded teaching and research activities. He also reinforced existing programmes in response to the needs of the Ohio Department of Transportation, and to the local construction industry. Papers describing the Ohio State years include *Option Packages for Undergraduate Technical Depth* and *Construction as an Option within Civil Engineering* [5][6]. During his years at Ohio State, the author also organised two national level conferences on civil engineering education, reported in *The 1974 ASCE Conference on Education: a Review and Evaluation* and *Where Does Civil Engineering Education Go From Here?* [7][8]. In preparation for further administrative advancement, the author spent an intensive summer at Harvard Business School in the Institute for Educational Management.

Engineering education has always engaged in self-study and renewal, and civil engineers in the USA have been particularly active in doing so. The author organised two major conferences while a civil engineering department head at the Ohio State University, focusing on educator-practitioner interactions and the changes needed in the curriculum to adequately prepare graduates for several decades of effective professional practice. In addition to bringing together hundreds of involved educators and practitioners for conference interaction, publications following up the conferences impacted a wide swathe of the profession.

A second step into academic administrative leadership came when the author moved to the University of Massachusetts (UMass) at Amherst as Dean of the College of Engineering. The timing of this move immersed him in expanding the size and scope of that College significantly in response to the needs of the burgeoning demands of the high-technology industry in the 128-belt around Boston. One major achievement during his UMass years was the rejuvenation of a programme in microwave engineering, which provided a much needed flow of well prepared graduates to the state's high tech industry. His papers began to reflect broader interests in engineering education, such as *Engineering Education for the 21st Century* [9]. One major activity was leading the first capital campaign ever conducted at the UMass to revamp the engineering laboratories. *Fund Raising for Laboratory Renovation* reports lessons learned during that experience [10]. While serving as Dean, the author also hosted the annual meeting of the American Society for Engineering Education on the UMass campus, attracting some 3,000 participants.

As the pre-eminent engineering education organisation in the USA – and perhaps the world – the American Society for Engineering Education (ASEE) attracts several thousand participants in its annual meetings. In the days when the society held its annual meetings on university campuses, the author hosted one such annual meeting on the campus where he was serving as the Dean of Engineering – the University of Massachusetts. He and his staff (and family) set the tone of the conference by arranging keynote speakers, such as Michael Dukakis, in the time between his service as Governor of the state and candidate for the US presidency. They also organised all the logistics of the conference – accommodations, meals, field trips, family events, etc. The quality of this conference set a high mark for successive annual meetings.

The next major step up the academic administration ladder was the author's appointment as Academic Vice President at Boston University. He was invited to that position at the time when Boston University wanted to make major investments in developing its science and engineering programmes. He was active in the design and implementation of a major new science and engineering building complex, fund raising for that development, the attraction of key faculty leaders for the effort, and the expansion of educational and research programmes. During his years at Boston University, the author also was heavily involved in faculty evaluation, as seen in *Weighing the Criteria*, and in faculty union issues, as illustrated in *Impact of a Collective Bargaining Contract* [11][12].

His final step in academic management was his appointment as President of the University of Delaware. During his short term as President, he emphasised strategic planning and the improvement of the mix of minority faculty members and students on campus. The planning effort was described in *Nine Themes Emerge from Project Vision Review* [13]. His inability to persuade the University Trustees, heavily

Working at the interface of the university and industry over most of his career, the author built many bridges for mutual benefit of those two camps. While at the UMass and Boston University in particular, he was heavily involved in instituting mechanisms for providing industry input to his academic units, and in gleaning support from industry for the enhancement of the engineering programmes he was responsible for. Perhaps his best success was restarting and updating a programme in microwave engineering at the UMass, with major support from the Raytheon Company. That programme provided – and still provides – top quality microwave engineering graduates at the Master's level to meet the needs of the high tech industry in the 128-belt around Boston and beyond.

dominated by elderly members of the DuPont family, to take a progressive approach on racial balance at the University led to his resignation – which is described in *Why I Resigned as President* [14]. After stepping down as President, the author continued service at the University of Delaware for some time as a University Research Professor. One major accomplishment during that period was conducting a National Science Foundation (NSF) funded project on technological literacy, including holding a major national level conference on the topic. That work is described in *Technological Literacy for Non-Engineers* [15].

Convinced that the population at large needed to better understand engineering and technology, the author led a movement to promote technological literacy among non-engineers. With funding from the US National Science Foundation, he organised a major national conference, which brought together the leading experts in the field, to review models and make recommendations to the profession. The resulting major publications, aimed at engineering deans and faculty members, advocated for engineering schools to offer tech literacy courses to non-engineering students on campus (liberal arts, business and education majors, for example). The author himself developed and taught such a course at the University of Delaware.

During that period, he also returned to student status, and earned a Master's degree in liberal studies at the University of Delaware – in a programme that he had initiated while President. His Master's thesis was published as *Education of Engineers for International Practice* [16].

In a final formal career move, the author became Executive Director of the National Society of Professional Engineers – a member-based organisation of licensed professional engineers based in Alexandria, USA. As a Professional Engineer himself, licensed in several states, the author had been active in NSPE committee activities. During his years as CEO of the organisation, he stressed service to members as the way to reverse membership decline – and was successful in turning the membership numbers back up. He instituted a major annual meeting for the membership, developed insurance and other programmes for members and streamlined the operation of the headquarters staff. *NSPE National Meetings for All Members* describes one of these initiatives [17]. During his years at the NSPE, the author was heavily involved in negotiations with engineering organisations in the USA, Canada and Mexico as the engineering profession struggled to implement the North American Free Trade Agreement (NAFTA). *Expanding Cross-Border Engineering Practice* describes that activity [18].

When US President Clinton signed the NAFTA agreement with Mexico and Canada, the engineering profession was asked by the US Government to facilitate the cross-border practice of engineering among the three countries. As Executive Director of NSPE, the author and his professional colleagues were major participants in the negotiations. Unfortunately, the structure of engineering licensure in the USA – where each of 55 state-level jurisdictions controls engineering practice locally – made it impossible to get any reasonable agreement on allowing Canadian and Mexican engineers to practice in the USA, short of meeting the stringent education, practice and test requirements of each state in which they wished to practice. So NATFA for engineers is currently only operative between Canada, Mexico and the State of Texas!

Having established a productive network of contacts and activities in Washington, DC and internationally, the author left the NSPE to work as a consultant in an active semi-retirement. He continues that activity today, consulting for industry and chairing several national and international organisations.

PROFESSIONAL SOCIETIES

While a student, at both the undergraduate and graduate levels, the author was active in engineering profession organisations – particularly in the American Society of Civil Engineers (ASCE). Then throughout his career, he continued such professional society involvement – expanding it in scope and responsibility levels.

During his time at the MIT, he was elected to the ASCE National Board of Direction – representing the New England States. After moving to Ohio State University, he was again elected to the ASCE Board – this time as Director from three Midwest states, then as Vice President for one of the four geographic zones of the organisation. The author has served on and chaired dozens of committees for the ASCE over the years, and continues to serve on some. One major activity while serving on the Board was helping the profession come to grips with rampant unethical conduct – primarily kickbacks from engineers to political figures in order to get contracts. His major paper describing those years, *Kickbacks Versus Professional Ethics*, became a case study for ethics courses for engineering students [19].

> Unethical and illegal practices in the engineering profession surface periodically in various geographies – and the author happened to be serving on the Board of Direction of ASCE when a spate of cases of illegal kickbacks to politicians by engineers came to the surface. He and his colleagues held hearings on each allegation of such conduct, typically ending in expelling the involved engineers from the Society, and asking that their license to practice be revoked. Some of the most flagrant cases involved Spiro Agnew, during his years as a county executive then Governor of Maryland – eventually leading to his resignation while later serving as Vice President of the USA.

The author served on the Accreditation Board for Engineering and Technology (ABET) for many years, first as an evaluator of civil engineering programmes, then as a member of the group that led evaluation visits, and finally as President of the ABET. He led the development of accreditation criteria for the surveying and construction fields. During his term as President, he led in the restructuring of the large, complex Board, and initiated a move to facilitate accreditation of graduate engineering programmes. The first of these efforts succeeded, and the second failed – as a majority of deans of engineering opposed having the ABET involved in their graduate offerings. His year as President is described in *1988 ABET President's Address* [20]. One of the major accomplishments during his leadership period was the establishment of the Washington Accord, a cross-border mutual recognition mechanism that has grown beyond its original six members and is now the *gold standard* for engineering quality assurance at the international level. The paper, *International Trends in Engineering Accreditation and Quality Assurance*, describes these international developments [21].

> The Washington Accord, destined to become the *gold standard* for engineering accreditation internationally, was developed during the author's term as President of the ABET. Visits by accreditation activists among the original six English-speaking countries led to a mutual recognition system that treats engineering graduates in any of the countries as if they were graduates in the country where recognition is being sought. The Accord has grown over the years, with more countries being accepted into membership, and its standards have set the norm for engineering accreditation around the globe.

Long active in the American Society or Engineering Education (ASEE), the author is currently chairman of its International Division. He has served on the organising committees for several ASEE International Colloquia. He previously chaired a major task force evaluating advanced technologies for classroom and laboratory use in engineering education – described in *Uses of Educational Technology* [22].

> The ASEE asked the author to chair a major task force to evaluate the educational technology that was creeping into the classrooms and laboratories of engineering schools in the 1980s, and to make recommendations on what types of technology should be introduced and at what pace. The resulting report – delivered in printed form and via a nationally televised session on the network of the National Technological University – recommended steps engineering schools should be taking in introducing computers into the classroom and laboratories, the use of video recordings to time-shift and distance-shift continuing education for practicing engineers, etc).

One technological application developed by the author and several of his colleagues in more recent years is the electronic conference, which allows engineering educators who cannot get to international engineering colloquia and conferences to participate electronically. Successful e-conferences, aimed primarily at engineering educators in developing countries, have been run in conjunction with annual meetings of the European Society for Engineering Education (SEFI) and the ASEE.

In the American Association of Engineering Societies (AAES), the author has long served on the International Activities Committee. He also has worked through the AAES to conduct a major study on the utilisation of engineers in industry, as described in the paper *Better Utilisation of Engineers – Results and Conclusions of NSF Utilisation Study* [23].

Concerned about how engineers were being utilised in industry as computer aided design, word processing and other advanced technologies were sweeping the workplace in the 1980s, the author and his colleagues obtained funding from the US National Science Foundation and the US Department of Defense to undertake a major study on the utilisation of engineers. Through fact-finding visits to interview engineers and their managers at several major employers of engineers, as well as a major survey, the research team was able to glean a clear picture of how engineers were coping in the transition to computer support instead of technicians and secretaries. The results of the study were published widely and presented at several national meetings.

During some 18 years when the USA took itself out of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the author became engaged in keeping vital parts of the relationship between US engineers and UNESCO alive. He co-chaired a committee which provided advice to the Director General of UNESCO, and in that capacity organised two major international conferences on engineering education in Paris, France, at the UNESCO headquarters. The paper, *Accomplishments of the International Committee on Engineering Education under the Auspices of UNESCO* describes that activity [24]. One of the major accomplishments of that period was the formation of the UNESCO International Centre for Engineering Education (UICEE), based at Monash University, Melbourne, Australia. That Centre has grown and flourished in the intervening decade, and now has a major international network of collaborating universities. A recent review paper in the *Global Journal of Engineering Education* – which is published by UICEE – called *UNESCO-Based Efforts at Capacity Building: from 1992 to 2005* chronicles the development of the UICEE [25]. The author remains active with UNESCO now that the USA has rejoined, serving on the US National Commission on UNESCO as a representative of the US engineering profession.

Conferences organised by the author and his colleagues at UNESCO headquarters in Paris in the early 1990s led to the development of several action projects – including the formation of the UNESCO International Centre for Engineering Education (UICEE) at Monash University in Australia. The Centre was established to serve the needs of engineering educators, particularly in developing countries, for continued professional development. Over the years, it has provided opportunities for such professional updating to engineering educators around the globe through a series of annual conferences and the establishment of the *Global Journal of Engineering Education*.

In recent years, the author has been very active in stimulating key bodies, such as UNESCO and the World Federation of Engineering Organisations (WFEO), to develop programmes in technical capacity building for economic and social development in developing countries. Working with the new US Ambassador to UNESCO, he and his WFEO colleagues were instrumental in getting the UNESCO governing body to establish a cross-sectoral programme in capacity building, involving its engineering, education and ICT sectors. In parallel with that effort, the author led in the establishment of an active new standing committee on capacity building within the WFEO structure – an effort that he has chaired since its initiation in 2003.

In the international engineering arena, the author has been active in the Pan American Association of Engineering Societies (UPADI) and the World Federation of Engineering Organisations (WFEO). He was General Chairman of the 1990 biannual meeting

of the UPADI, held in Washington, DC. He currently serves as Chair of the UPADI Education Committee and is a member of the team planning the 2006 UPADI biannual conference in Atlanta. The paper, *Convention Summary*, describes the 1990 meeting [26].

Long active as a member of the WFEO Committee on Education and Training, the author was asked in 2003 to form a new standing committee for the WFEO – the Committee on Capacity Building, hosted by the US American Association of Engineering Societies. This Committee has some 40 members from about 25 countries, and is actively engaged in projects to develop technical capabilities in developing countries in order to enhance economic development. The paper titled *Engineering Capacity Building in Developing Countries to Promote Economic Development* describes recent and current Committee efforts, with an early focus on Latin America and an emerging concentration on sub-Saharan Africa [27].

The initial thrust of the WFEO Committee on Capacity Building has been the *Engineering for the Americas* programme. The author and his colleagues, working through the Organization of American States (OAS), have obtained formal support from the Ministers of Science and Technology of the 34 countries of the OAS, and the presidents of those countries, to make the enhancement of engineering throughout Latin America and the Caribbean a top priority. At a major conference in Lima, Peru, in late 2005, educators, industry leaders, and government officials gathered to pursue technical capacity building throughout the hemisphere of the Americas.

Several years ago, concerned that many engineering educators were not taking a sufficiently global view of their field, the author founded the *International Engineering Education Digest.* This monthly digest of published articles that are of interest to engineering educators provides summaries of key articles from many sources, and lists the location where the entire article may be read with the click of a mouse. It is distributed free to some 70,000 engineering educators around the globe through several professional societies.

All back issues of the Digest are posted on the World Wide Web at www.worldexpertise.com. That Web site also contains the full texts of all papers that the author has written or co-authored in recent years.

Persuaded that engineering educators needed continued stimulation in international matters if they were to attend to adequately preparing their graduates for international practice in the global economy, the author founded a monthly electronic newsletter that now goes to many tens of thousands of engineering educators around the world. The *International Engineering Education Digest* provides summaries of print and electronic articles of import and interest to engineering educators, and facilitates access to original articles for possible follow-up by readers. It has proven to be a popular way for busy educators to stay abreast of developments – with the author and his co-editor, Bethany Oberst, searching out relevant materials and providing cogent summaries.

RECOGNITIONS AND AWARDS

The author's accomplishments in engineering education and beyond have been recognised by his election to Fellow status in several organisations, specifically: the American Society for Engineering Education, American Society of Civil Engineers, Accreditation Board for Engineering and Technology, American Association for the Advancement of Science, Institution of Engineers of Ireland, National Society of Professional Engineers, and the Royal Society for the encouragement of Arts, Manufactures and Commerce (UK). He has recently been elected to Honorary Member status in the American Society of Civil Engineers.

In addition to the ASCE Collingwood Award mentioned previously, the author has been awarded the ASCE Friedman Professional Recognition Award and the International Medal of the Australasian Association for Engineering Education. He was named Delaware Engineer of the Year in 1994, and was awarded the University of Massachusetts Engineering Alumni Association Award. He spent a year as Senior Fellow at the American Council on Education.

SUMMARY AND CONCLUSIONS

One of the author's daughters recently asked him, *When are you going to retire?* He answered as follows:

> *I am as retired as I am ever going to be – spending full time and all available effort and resources to address some of*

the major issues in the world – poverty reduction, economic development, technical excellence, etc. Assisting developing countries to build technical capacity in order to attract direct foreign investment, to use aid monies more effectively, and to stimulate small to medium businesses through entrepreneurial activity as a capstone to his academic and professional career is proving extremely rewarding – and effective.

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BIOGRAPHY

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Dr Jones received his education at Carnegie Institute of Technology, earning degrees in civil engineering and materials science. Prior to returning to Carnegie for his doctoral study, he worked as a practicing civil engineer. He has spent much of his career as an educator, starting with engineering education and broadening to higher education as a whole. After completing his doctoral degree in 1963, he taught for eight years on the faculty of the Massachusetts Institute of Technology. He then served in a succession of administrative posts in higher education, for several years each: Chairman of Civil Engineering at Ohio State University, Dean of Engineering at the University of Massachusetts, Academic Vice President at Boston University, and the President and University Research Professor at the University of Delaware.