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Arthur Porter
1910-2010

In a lifetime that spanned 99 years, Arthur Porter was engineer, scientist, professor, administrator, as well as an influential advisor to industry and governments. He died in Winston-Salem, North Carolina on February 26, 2010, where and his wife, Patricia (d. 2007) had moved in 1999.

In December of 1910 Arthur was born in the small town of Ulverston in north-west England. His interest in the sciences was stimulated by good teaching at Ulverston Grammar School but, after some disappointing exam results and a repeat year, he obtained a County Scholarship. This enabled him to enroll in the honors physics stream at Manchester University from which he graduated in 1933 top of his class with first class honors. It was during his final year that he expressed interest in the development of calculating machines. In fact, this was a topic that particularly interested Professor Douglas Hartree for the purpose of solving certain differential equations (the Hartree self-consistent field equations) for estimating the wave functions of multi-electron atoms. Enrolled for an MSc degree, Arthur constructed from Meccano parts an anolog differential analyzer and demonstrated that it could predict the wave-functions for hydrogen and chromium. Accurate to about 2%, this remarkable achievement together with two publications likely ensured his acceptance as a PhD student also under Hartree. His thesis entitled *The Differential Analyser and Some Applications* was successfully defended in 1936. By winning a 2-year Commonwealth Scholarship in 1937, Arthur Porter was able to continue his research on analog differential analysers by working at MIT under the pioneer of this field, Vannevar Bush. MIT also provided the opportunity of working closely with other pioneers such as Claude Shannon, founder of modern communication theory, and Norbert Wiener, founder of the field of cybernetics.

Returning to the UK shortly before the start of WW2, he was persuaded by Professor Bragg to join the Admiralty Research Laboratories where he worked on a variety of war-related problems. But his tenure was short-lived and, by mid-summer of 1940, he joined what was to be known as ‘Blackett’s circus’ — a small group of eminent scientists that would establish the basis of modern Operations Research. One of their immediate tasks was to optimize the placement of anti-aircraft batteries in and around London so as to achieve maximum destructive effect. It was during this time that he first met Patricia Dixon, whom he married in July 1941. The period of 1940-41 was the time of the ‘Blitz’ so that living and working in London at that time was fraught with danger. Around 1942 the Porter family moved, first to Christchurch on the south coast and subsequently to the radar research laboratories in Malvern, where he was engaged in some initial design work using servo-mechanisms to make anti-aircraft guns automatically controlled by radar. Late in 1943 he returned to London with the task of advancing the development and application of servo control systems particularly through the ‘Servo Panel’ and also to ensure that the three Armed Services were kept fully informed of developments in this field.

Early in 1945 he visited the US to exchange ideas and, with the impending conclusion of the war in Europe, he was asked to assess the potential applications of control systems in industry. The outward journey was a six-leg flight on a Pan-American Super Clipper ending in Chesapeake Bay. During this 2-month visit he spent time at the MIT Servo laboratory and also at the Bell Telephone Laboratories in Murray Hill. It was there that he met and had discussions with the founders of feedback control systems namely, Henry Nyquist and H.W. Bode. Shortly after his return to the UK, with the end of the war and after completing his final report to the

Ministry of Supply, he spent three weeks in occupied Germany to help reduce the threat of forceful removal of scientists to the Soviet Union. Following a brief stint with the newly established Metrology Division of the National Physical Laboratory, he was appointed as Professor of Instrument Technology at the Royal Military College of Science in Shrivenham. During his tenure there he was invited to give a lecture at the Institute of Mechanical Engineers on the principles of automatic control systems. The resulting paper was published in 1947 in the Institute's Proceedings and was awarded their 1947 prize. This, together with his publications a decade earlier and his wartime research, established Dr Porter as a leading expert in this field. This expertise was cemented by the subsequent publication (1950) of a short but popular book: *Introduction to Servomechanisms* (Methuen, London), which went to a second edition (1952) and was reprinted in 1954 and 1957.

A few years later he was offered the opportunity of heading-up the newly established research department of Ferranti Electric in Toronto. In September 1949 the family with their 2-year old son John embarked by liner for Montreal. Part of his responsibility was the development of digital communication systems, resulting in the design and demonstration of one of the world's first digital data transmission systems. During this period he was also a member of 6-person Canadian delegation to Project Lamp Light studying the air defense strategy for North America. It was in 1955, as this project was terminating, that Professor Patrick Blackett, then Head of Physics at Imperial College, and with whom he had worked during the wartime period, appears to have had little difficulty in convincing Dr Porter to favorably consider the offer of a newly established Chair of Light Electrical Engineering at Imperial College.

In the 1950's Imperial College was in the process of building a Faculty of outstanding ability and potential. Thus, the move to London in July 1955 was particularly attractive especially since one of the other experts in control theory, Arnold Tustin, had just been appointed to the Chair of Heavy Electrical Engineering. Moreover, being closer to the elderly parents of Patricia and Arthur was an added bonus. However, the heavily polluted atmosphere of London in the mid 1950's was a serious worry especially insofar as the health of their son John was concerned, so a new move to a healthier climate was considered. This was aided by a letter received in 1957 from C.J. Mackenzie enquiring as to whether Professor Porter would consider moving to the University of Saskatchewan in Saskatoon as the new Dean of Engineering. The acceptance of this new position was a difficult family decision.

In the summer of 1958 he bid farewell to many friends and colleagues and moved to Saskatoon where, in typical fashion, he met and made many new friends. Fortunately, his prior knowledge of the Defense Research Board (DRB) of Canada helped him obtain substantial research support and this, together with new research staff and graduate students, enabled him establish a research program. It was later in 1958 that he met Dr. William Feindel at a party given by the university President. Dr. Feindel had been appointed in 1955 to the new University Hospital in Saskatoon and had established a neurosurgical department. This meeting was to have a profound influence on the development of Biomedical Engineering in Canada. Dr. Feindel was particularly interested in techniques for measuring cerebral blood flow. He had already developed, with the radiation physicists at the Saskatoon Cancer Clinic, Canada's first automatic brain scanner using radio-isotopes to diagnose brain tumours and strokes. The two discussed the potential role that the latest developments in electronics could have in such measurements.

Fortunately, Dean Porter knew that one of the best people to tackle such problems was Norman Moody, currently working at DRB in Ottawa. He proceeded to sound-out Norman to see if he would be willing to apply for a Professorship of Electrical Engineering and Chairman of the EE Department. The major difficulty was that Norman had no university degree. Eventually this problem was solved and it was agreed that Moody should be awarded an honorary BE degree by the University. The arrival of Norman in 1959 marked the start of biomedical engineering research at any Canadian university and was amongst the first programs in North America.

Shortly after Dr Porter's arrival in Saskatoon a number of attractive new appointment opportunities arrived, which included was an offer from the University of Toronto, instigated by his friend and mentor Dr Omand Solandt. And so it was, he informed President John Spinks that he would be leaving in 1961, and that he knew of a potential replacement in the person of Andrew Booth, a pioneer in digital computers. Although this was to be Arthur's last formal academic appointment, it was far from the end of his career.

The offer from the University of Toronto was for a Professorship and Chair of a new department in the Faculty of Applied Science and Engineering — that of Industrial Engineering. But, because he was appointed Project Officer for the Federal government Glassco Commission from July to December, he was unable to take up his new position on a full-time basis until January 1962. During the initial period of his appointment he realized that there was interest in the collaboration between engineering and medicine, particularly through the department of Electrical Engineering. Arthur persuaded the Dean of Engineering, (Roland McLaughlin) and the Dean of Medicine, (J.D. Hamilton), that the establishment of a new Institute would foster this relationship. Their acceptance of this notion resulted in the suggestion that Norman Moody be appointed as Professor of Electrical Engineering with the objective of establishing an Institute of Biomedical Electronics. It was also during these early days that he developed a close personal friendship and academic collaboration with Marshall McLuhan, a professor of English Literature at the University of Toronto and an internationally known media theorist, who was the founding Director of the Center for Culture and Technology. During McLuhan's 1967-68 year at Fordham University, Arthur undertook the acting Directorship of this Center. By this time, the Department of Industrial Engineering was running smoothly, with around 40 students graduating each year and an active research program.

A major commitment during his early days in Toronto was as Chair of the Science and Technology Advisory Committee for the Montreal 1967 World Exhibition (Expo '67, *Man and His World*). The Committee was responsible for six of the Theme Pavilions which contributed in a major way to the outstanding success of Expo '67. Towards the end of this commitment he was named Chairman of the new Canadian Environmental Advisory Council for a 3-year term. His leadership and vision with this Council provided the impetus for the creation of a national movement of environmentalists, the first of its kind in Canada. Around the same time Dr Porter was appointed Academic Commissioner to the University of Western Ontario — a 2-year task that required a leave of absence from the University of Toronto from mid-1969 to mid 1971. It was during this period that he was elected a Fellow of the Royal Society of Canada (1970). Other honours and invitations ensued. These included an invitation to attend the centenary (1971) celebrations of the Institute of Electrical Engineers in London, where he delivered one of the eight centenary lectures entitled "Control, automation and computers". In the early 1960's he

chaired an Ontario Commission on Automation and Employment, played a pivotal role in the design of a Satellite communications system for Northern Ontario, and was subsequently scientific advisor to the Board of Directors for the creation of a new Ontario Science Museum.
It was in 1975 that Dr Porter was appointed by the Ontario Government to chair a Royal Commission on Electric Power Planning with terms of reference that were broadened at the end of 1977 to include an examination of the issues relating to nuclear power. This was to be a 5-year challenging commitment with major implications for the future of the Canadian nuclear industry. The 277-page interim report (*A Race against Time*) issued late in 1978 was especially prophetic, and spoke of the need to seek alternative sustainable energy sources, the need for conservation and the need to reshape our approach. In November 1978 the *New Scientist*, in a full article discussing this report, pointed out that it was "relevant to nuclear power planning, far beyond the confines of one Canadian province". The final report, consisting of nine volumes was presented to the Ontario Government early in 1980.

Although Arthur Porter officially retired from the University of Toronto in 1976, his consultation work continued for a period into the late 1980's. He was awarded the Order of Canada in 1988 and, was given an honorary DSc by the University of Manchester in 2004. Some might regard the preparation and writing of the Royal Commission Report as the pinnacle of Arthur's outstanding interdisciplinary career. To this day, the Report provides a valuable guide for the choice of renewable energy policies in Ontario. The circumstances surrounding its preparation are described in his autobiography, *So Many Hills to Climb*: *My Journey from Cumbria to North Carolina* (Beckham Publications, 2004). It was written while Arthur was in his 90th year, and contains fascinating accounts of his war-time experiences, details of family life, together with his scientific and professional work. It was the primary resource for the preparation of this obituary.

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