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"Rolt, Petrosky and Legget: Engineer-Historians"

by Andrew H. Wilson
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EIC HISTORY AND ARCHIVES

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Abstract

These three engineers have made major contributions to the written history of engineering in Britain, the United States and Canada.....unusually for engineers, and their work in this field has been widely recognized. This paper discusses their differing backgrounds and published contributions, what made them effective as historians, and the importance of their work in relation to the science-engineering dichotomy.

This paper was presented, in part, by the author at the 17th biennial conference of the Canadian Science and Technology Historical Association, held in Ottawa, Ontario, on 19 November 2011.

Photographs of the three engineers appear on the last page of this paper.

About this Series

Principally, the Cedargrove Series is intended to preserve some of the research, writings and oral presentations that the author has completed over the past half-century or so but has not yet published. It is, therefore, a modern-day variant of the privately-published books and pamphlets written by his forebears, such as his parental grandfather and grandmother, and his grandfather's brother John.

About the Author

He is a graduate in mechanical engineering and the liberal arts and has held technical, administrative, research and management positions in industry in the United Kingdom and the public service of Canada, from which he retired 25 years ago.

He became actively interested in the history of engineering on his appointment to chair the first history committee of the Canadian Society for Mechanical Engineering in 1975 and served both CSME and the Engineering Institute of Canada in this capacity for varying periods of time until 2003. He has researched, written and edited historical material for both organizations, and is a past president of both.

Introduction

It is quite unusual for engineers to write about the history of their profession and what it has accomplished in years past. Part of the reason for this is the apparent lack of sustained attention that engineers, generally, give to this history - or to any history, for that matter. But part is also due to the fact that engineering history is either downplayed or largely ignored by 'real' historians or is, wrongly in my view, included as part of the history of *science.*

L.T.C (Tom) Rolt and Robert F. Legget were engineers - as Henry Petroski still is - who have made significant contributions to the *corpus* of published material in this sub-field of history. Rolt, a Briton, wrote principally about British engineers during Queen Victoria's reign. Some - like Telford - worked mostly in civil engineering. Others, like I. K. Brunel and the Stephensons, straddled several disciplines. His working experience had a strong mechanical base. Of the three, it might be said that Rolt was, personality-wise, the most 'colourful' and may well have been the most prolific, although he has strong competition from the other two. He was also the one who gave up the regular practice of engineering once he began writing.

Petroski, an American, has covered engineering in both the 19th and 20th centuries, as well as in much earlier times, and is still researching, writing and publishing in the present one. He is unique in that he holds university appointments in both civil engineering and history. Of the three, it is possible that Petroski will end up being the best known among both engineers and lay people, and the most influential.

Legget, who was born in Britain but spent most of his working life in Canada, has written principally about the early civil engineering in this country, and especially about canals and railways. His work experience was broadly based. He served in the industry, university and government sectors. Of the three authors, Legget has been perhaps the one most involved in the politics of the profession, which may have influenced the historical writing he did.

Rolt

Tom Rolt was born in Chester, England, in 1910. His early years were spent further south, at Hay-on-Wye in rural Welsh Border country. At a young age, he developed both a love of the countryside and a fascination with machines. His family had no strong engineering connection, although one relative was a mechanical engineer and an inventor of considerable ability. It was he who advised Rolt's parents to apprentice him in the mechanical field. In 1926, young Rolt left school to serve as a pupil with an agricultural engineering firm. He worked mostly on steam ploughing engines. In June 1928, he began a three year apprenticeship with Kerr, Stuart & Company, locomotive engineers at Stoke-on-Trent, but the firm collapsed before this was finished. However, he managed to finish his 'time' with the R.A. Lister Company of nearby Dursley.

By then, in the early1930s, he had become enthusiastic about vintage cars and in owning them. So

he took a series of short term jobs until he was able to set up in business with some friends to service these vehicles. He was also involved in the establishment of the Vintage Sports Car Club. At the same time, he developed an interest in the English canals, in the narrow boats that sailed them, and in one of these in particular - the *Cressy* - which belonged to the family responsible for his entry into engineering. An opportunity to acquire the *Cressy* for himself came just as Rolt's literary ambitions were beginning to stir within him. He also began to appreciate the tourist/leisure potential of the canals and their boats, as well as that of the narrow gauge railways.

Late in 1938, Rolt sold his share of the garage and, in 1939, was married. The *Cressy* served as home for him and his new wife. This development also provided the solution to his financial problems, since his new father-in-law - disapproving of Tom - had cut the allowance he had been providing to his daughter. The boat also provided a place for him to work at his new occupation - writing. His first book, *A Painted Ship*, failed to find a publisher until 1944, when it appeared under the title, *Narrow Boat*. This book led to the formation in 1946 of the Inland Waterways Association, of which Tom became the first secretary. It also proved that his writing abilities were substantial.

However, by 1951, things had changed for him. His marriage failed, and the IWA expelled him during a policy dispute. He then turned his attention to a mechanical outlet for his enthusiasm - the Talyllyn Railway, a privately-owned narrow-gauge line in central Wales, of no interest to the then nationalized British railway system. He applied his organizational and mechanical skills to its Preservation Society, turning it into a flourishing operation, restored and operated by volunteers. This was only the notable first in a number of such transport system preservations in which he took part.

Around this time, Tom married again. His new wife, Sonia, had been one of the young women trained during World War II to operate canal boats. She had also been associated with the IWA, where she had met Tom. They lived on land, however, in a house in Gloucestershire that had belonged to Tom's father. Here their two sons were born, and here Tom died in 1974, at the early age of 64.

After the *Narrow Boat* in 1944, Tom published regularly. A bibliography of his writings, compiled by Ian Rogerson and Gordon Maxim, with the assistance of Sonia Rolt, was published by M&M Baldwin in 1986. In it, Rolt's publications are listed in several categories - for example: waterways; railways; motoring and other transport; industrial history; biography and autobiography; and even a little fiction.

On waterways, in addition to the *Narrow Boat* he wrote a book on the canals of England, covering the history, construction and working of these waterways since the Middle Ages. He also wrote an account - with photographs by his first wife - of a journey on the waterways of the Republic of Ireland which they took in 1946, and a historical account of France's 17th century *Canal du Midi* which, apparently, had inspired the Duke of Bridgewater's canal in England a century later. He also wrote a half-dozen short pieces on inland waterways and contributed articles to such periodicals as *The Field, Country Life* and *Motor Boat and Yachting.*

On railways, he published two books and introduced a third that told the story of the Talyllyn Railway and its revival. He also wrote a book on the history of railway accidents, as well as over 30 articles, many of which appeared in the *Talyllyn News*.

On motoring, his book on the evolution of the motor car in England appeared in 1950 and on the history of motoring generally in 1964. A dozen articles on motoring appeared in magazines such as *Motor Sport* and the *Vintage Car Club Bulletin* and another in the *Sunday Times*.

Under the heading of other transport, he wrote about the history of ballooning from 1783 to 1903, the building of Britain's first motorway, the Severn Bridge (built in1966) and the Tyne and the Mersey Tunnels.

Industrial history is one of the two more important categories of Tom Rolt's writing. This category includes a number of books and longer essays. Among the former is *Victorian Engineering*, in which he discusses, for example, the early days of railway engineering and the building of locomotives, the design and construction of the Crystal Palace, the building of more than a dozen bridges and viaducts and more than two dozen steamships, the application of steam to a variety of machinery, the application of steel in place of wrought iron, the development of machine tools, and arrangements made for the public supply of clean water. Along the way, he touches on the careers of those who made major contributions to engineering during Queen Victoria's reign. Among his longer essays are the histories of a number of industries and companies from the same period. His articles in this category numbered around 30, and the publishers included the *Birmingham Post* newspaper, *Country Life* and *The Engineer* magazines, and the *Newcomen Society Transactions*.

The other more important category includes his lengthy biographies. Beginning with I. K. Brunel in 1957, followed by Thomas Telford in 1958, Richard Trevithick in 1960, George and Robert Stephenson also in 1960, James Watt in 1962, Thomas Newcomen in 1963, and a 'younger reader's' version of the Brunel story in 1965. In this way, he tells the stories of many of the important engineers in English history during the 19th century. As a biographer, and given that he was writing about engineers and not political people, Rolt is not immune from criticism, either during or long since the appearance of his books. One such involved the controversy between Brunel and John Scott Russell, whose shipyard built the *Great Eastern*.

He wrote some 20 short historical pieces for a wide variety of publishers, including the *Institutions of Mechanical* and *Civil Engineers,* and published over 70 book reviews, most of which are connected with engineering. The Rogerson/Maxim list includes 25 items of published correspondence on all subjects, as well as some 20 items of biographical material on Rolt himself by other authors. Lastly, the list of Rolt's fiction includes two collections of short stories, one about engineering, the other not, two horror stories, and one long novel called *Winterstroke*, which describes in a fictional context the development of the early iron industry in England.

Rolt's ability, experience and contributions to engineering history were widely recognized during his lifetime. He became, for example, a vice-president of the Newcomen Society, which is devoted

to the engineering branch of history. He was a member of the Science Museum Advisory Council, and was instrumental in the establishment of the Railway Museum at York. He was elected a Companion of the Institution of Mechanical Engineers, and he received two honorary master's degrees.

Petroski

The youngest of the three, and the one who is still writing, is Henry Petroski. These days, he seems to produce at least a book, plus lectures, refereed journal articles, and conference presentations each year, and at least an article each month in the magazine *American Scientist*. His technical specialties are structural engineering and success-and-failure analysis in engineering design. These subjects - not surprisingly - show up frequently in his written material. He also has concerns about the nature of science, technology and invention in relation to engineering and its history. Among his research sponsors have been the U.S. Corps of Engineers, the NSF, the Sloan Foundation, and the university where he now teaches. Much of his writing is aimed at the general reader and is intended to explain what engineering is and what engineers do.

Petroski is a native New Yorker, born in Brooklyn in 1942. A 1963 bachelor graduate in mechanical engineering from Manhattan College, he obtained master's and doctorate degrees in applied mechanics from the University of Illinois-Urbana in 1964 and 1968. After graduate school, he was on the engineering staff at the Universities of Illinois and Texas until 1974, after which he spent five years at the Argonne National Laboratory where he was a group leader responsible for development work on fracture mechanics.

Since 1980 he has been Aleksander S. Vesic professor of civil engineering and has a secondary appointment as a professor of history at Duke University, North Carolina. He has also served on the U.S. Nuclear Waste Technical Review Board. He is a member of the National Academy of Engineering, the American Academy of Arts and Sciences, and the American Societies of Civil and Mechanical Engineers. For the ASCE, he has chaired its History and Heritage Committee. His honours and awards are, to say the least, numerous. He has also been asked to give many distinguished lectures and keynote addresses.

For Petroski, engineering began a very long time ago, when solutions to everyday problems were sought and found in nature, when rocks became hammers. He began his series of regular contributions to the *American Scientist* about 30 years ago and has written on a wide variety of subjects, ranging from ancient history (for example, on Vitruvius and Machu Picchu), through modern machinery and engineering (for example, tower cranes and controlled demolition) to more philosophical topics, such as scientists as inventors, and the 'anonymous' profession - engineering. Material that has appeared in them has been adapted for his books, of which there are now 16, produced by a variety of publishers. The latest, *An Engineer's Alphabet: The Softer Side of the Profession*, appeared only a few weeks ago.

His first book (1982), *To Engineer Is Human: The Role of Failure in Successful Design*, established one of the main themes of his writing: that the possibility of failure is an essential part of successful engineering. His other books have been:

Beyond Engineering (1985) is a series of essays based on earlier articles and was designed to justify the mixing of engineering with writing about it - in other words, both are forms of construction;

in *The Pencil* (1989), Petroski uses 400 pages to explain the origins of the pencil (in Roman times), its manufacture through the ages (by firms headed by the likes of the family of Henry David Thoreau), its many uses, and to justify the thesis that all 'made' objects - even the humble pencil - owe their existence to some kind of engineering;

then came *The Evolution of Useful Things* (1992): how, for example, the fork got its tines; how pins became paperclips; how the zipper evolved; and how some tools make other tools;

in *Design Paradigms: Case Histories of Error and Judgement in Engineering* (1994) he argues for a more pervasive use of case studies in the undergraduate engineering curriculum because of the practical wisdom and experience that they contain;

which was followed by *Engineers of Dreams: Great Bridge Builders and the Spanning of America* (1995), one of Petroski's more impressive books, which provides extensive material and discussion on the careers of a half-dozen eminent American bridge builders and the construction of their bridges;

Invention by Design: How Engineers Get From Thought to Thing (1996) expanded on the thought that engineering entails more than knowing the way things work; it is also concerned with economics, aesthetics and ethics, even for things as small as the tab of a beverage can or as large as the cabin design of a turbojet;

Remaking the World: *Adventures in Engineering* (1997) is a series of essays based on earlier columns. They discuss several very large projects, such as the Panama Canal, the Channel Tunnel, the QE2 and Kuala Lumpur's Petronas Towers; profile several eminent engineers, such as machine tool manufacturer James Naysmith, General Electric's Charles Steinmetz, and Karl Terzaghi of soil mechanics fame, as well as discussing the harnessing of steam, the evolution of personal computers, the Nobel Prizes, and the proposition that engineering is driven by economics. He also deals with the I.K. Brunel-John Scott Russell controversy;

The Book on the Bookshelf (1999), is rather different, being a history of books, libraries, publishing and bookbinding rather than a conventional piece on the history of engineering;

Petroski's next book (2002) is in the form of a personal memoir of his early years in the Boroughs of Brooklyn and Queens in New York City; it is called *Paperboy*, and discusses the influence his four years delivering evening newspapers had on his later decision to follow engineering as a career;

Small Things Considered: Why There is No Perfect Design (2003) provides a perspective on the role of design in everyday life and, in particular, with regard to commonplace items such as the dixie cup, electrical outlets and paper bags, many of which are of contemporary rather than historical interest;

Pushing the Limits: New Adventures in Engineering (2004) is another impressive book, dealing with boundaries in the design and construction of longer bridges, taller buildings and unusual structures; it looks to the future as well as to the past and reflects one of Petroski's professional specialties - structural engineering;

in *Success Through Failure: The Paradox of Design* (2006), Petroski returns to his major theme and describes failure in design as "a unifying theme for describing the functional evolution of things"; the book itself was written in parallel with a series of three invited lectures the author gave at Princeton University in 2004;

then comes *The Toothpick: Technology and Culture* (2007), which resembles the earlier book on the pencil in that it discusses the manufacture and uses of toothpicks; it was originally intended to be a chapter in an earlier book, but grew to be a self-contained one on its own account;

in *The Essential Engineer: Why Science Alone Will Not Solve Our Global Problems* (2010), Petroski explores the ways in which engineering differs from science and the ways in which they must work together to address the world's pressing issues; more on this subject in a moment;

finally, with regard to *An Engineer's Alphabet* (2011), I can say nothing about it as yet; I have not yet bought a copy, but hopefully Santa Claus may put one in my stocking next month!

Legget

Robert Legget's standing among engineer-historians is illustrated by his inclusion in the list of winners of the Heritage and History Award of the American Society of Civil Engineers, to which he was added in 1987. Other winners of this award include known names in the field, such as James Kip Finch, Samuel C. Florman and Henry Petroski.

Robert Ferguson Legget was born in Liverpool, England, of Scottish parents in 1904. He was

educated at the University of Liverpool, from which he graduated in 1925 with a first class honours degree in civil engineering, and geology, followed by a master's degree in engineering in 1927. From 1925 until 1929 he worked as an assistant with a firm of consulting engineers in the design of hydro plants for Scotland, Greece, Italy and Finland.

At the end of this time, he moved to Canada to take up an appointment with the Power Corporation of Canada, again on hydro work. In 1932 he joined the Canadian Sheet Piling Company as an engineer and was responsible for the design and construction of piling in construction projects across Canada. Since graduation, he had developed his interest in geology, and especially the mechanics of soils and the engineering of foundations.

With these new subjects in mind, he changed careers in 1936. He first took up a lectureship at Queen's University, and followed it with a professorial appointment at the University of Toronto. At Toronto, he also taught short courses and evening classes for engineers already in practice. During World War II, university engineering staff were considered essential for training potential combatants. So Legget took advantage of remaining out of uniform to participate in a number of significant projects, such as the Shipshaw Power Project and the Sarnia Polymer Plant. He also contributed to the design and construction of the Toronto Subway System.

Before the war ended in 1945, Legget was asked by the president of the NRC to chair several technical committees, including one on snow, ice and soil mechanics. In 1947, Dr. Mackenzie invited him to become the founding director of the NRC Division of Building Research and to develop national expertise in all aspects of this field. By the time he retired from this Division in 1969, it had become a major facility, known world-wide, for building and construction research. It employed around 250 people. Legget, at NRC, was also instrumental in beginning the study of permafrost and in the development of the model Canadian Building and Fire Codes.

Early in his career in Canada, Legget became active in the Engineering Institute of Canada, especially in its Toronto and Ottawa Branches but also at the national level. He was an active member of institutions in the United States and Britain. He wrote often about professional affairs, some of it historical. Throughout his life, he was also a keeper of old records. He maintained a writing schedule right up until his death in 1994, in his 90th year.

The academic and other honours and awards received by Robert Legget during his lifetime are too numerous to mention fully. These included induction into the rank of Companion in the Order of Canada, which has been achieved by few engineers, and his election as an Honorary Fellow of Britain's Institution of Civil Engineers and a Fellow of the Royal Society of Edinburgh. He was also a Fellow of the Royal Society of Canada, the founding president of the Canadian Academy of Engineering, and president of the Geological Society of America, the American Society for Testing and Materials and the International Council for Building Research (CIB). Among the dozen or so honorary degrees he received were ones from the University of Glasgow, Charles University in Prague, and his *alma mater*, the University of Liverpool. Many of these awards - like the one I mentioned at the beginning - recognized his contributions to engineering history.

Legget's enormously long list of writings, both public and personal, published and unpublished, can be found among the material in the almost 700 files of Finding Aid No. 1929 at Library and Archives Canada. This includes his books, articles and speeches, engineering-related and otherwise, of most of which he was the sole author. Only some are 'historical' - but when he was retired his output of this kind of material increased noticeably. The interesting thing about many of the non-historical ones - and especially those dealing with geology - is that they have *now* become important contributions to Canada's engineering history.

Among his history books are those he wrote on the Rideau and Ottawa Waterways, the Ottawa River Canals, railways in Canada, and a history of standards, which he did for the Economic and Science Councils in 1970. Notable among the biographical pieces are those on Alexander MacKenzie and Colonel John By. Among his many speeches are several that include strong 'pitches' for more recognition, research and writing activity in regard to Canadian engineering history.

As for both Rolt and Petroski, Legget's longer writings on engineering history, unlike his geology and other textbooks and some of his articles, were intended for the intelligent lay person and not solely for professional engineers. He took pains to explain why and how certain engineering works were built, and the economics and politics that often overshadowed such constructions. At the same time, he encouraged engineers to pay much more attention to the history and development of their profession than they had been in the habit of doing. Interestingly, his writing style may be considered somewhat archaic by North Americans since it clearly reflects the rigour of the public and high school education in the composition of English prose that Legget experienced in his youth.

One of his speeches - on receiving an honorary degree from the University of Waterloo - was later published in the October 1963 issue of *The Professional Engineer and Engineering Digest*. It is titled "Every Engineer Needs a Sense of History." In it, he admitted that he had "never come across a single young Canadian who had any such sense of history at all." He went on to suggest to his young audience that, while clearly looking forward with enthusiasm, they would be amiss if they did not also look backwards. Indeed, he said, the very name 'Waterloo' was enshrined in history for the battle fought there 150 or so years earlier. He also observed that, for the up-coming Canadian Centennial in 1967, little or nothing was being done to recognize the country's eminent engineers of the past - Sandford Fleming and the Keefer and Shanly brothers, for example.

As far as I can gather, Legget's observation may still be applied to today - in spite of what he himself and others have done to try to change the situation.

Effectiveness

One significant element in the effectiveness of these three engineers in the history field was, and is, that their writings were, or are, intended to appeal to much broader audiences than their fellow engineers. They have been careful with their use of jargon. In two of the three cases, their communication ability have also benefited from teaching experience. In Rolt's case, it was his

contacts with engineering-dependent organizations that included lay people among their members.

Another element is the fact that they have written a great deal of material over long periods of time, maintaining standards that allowed their work to be recognized and, in the cases of Rolt and Legget, survive their deaths. And while all three have been controversial in some of their writings, their positions have been taken with care.

The final element is that all three have written with the authority of their professional training and experience, and that they have done what very, very few engineers have ever done. Yet their contributions have been recognized by the profession, although not perhaps - with the possible exception of Petroski - with the same enthusiasm by the history profession. Rolt was an early pioneer of engineering history in Britain, as Legget was in Canada. To a larger extent, the way has been easier for Petroski, partly because others in the United States have been active in the field, and partly because his 'day' job - university teaching and research - has a tradition of publication. This is not to say that non-engineers cannot write about engineering history. Rather, it says that the writing of it can, and does, benefit sometimes by having it viewed from the inside.

Science versus Engineering

Why is this dichotomy important? Because it is one of the main factors inhibiting the understanding, telling and spreading the history of *engineering*.

At the same time, I understand that there is another important dichotomy that affects engineering, and the civil discipline in particular. This is the one between engineering and architecture. But in this case, some jurisdictions - Ontario, for example - have introduced legislation defining the responsibilities of the two. None such exists for engineering and its relationship with science.

In Rolt's day - and country - one did not question the 'superiority' of science, especially as an intellectual exercise. Much of professional engineering's reputation over the longer haul, especially in Britain, has also been tainted by the assumed 'dirtyness' of its practice in almost every form. Only consulting civil engineers were deemed to be gentlemen. As well, the mechanical and electrical varieties began life as trades, and the mining variety tended to be learned on the job. And, of course, there were no ladies in its practice - until relatively recently. There were none, for example, in my graduating class in 1949 and only a handful over the next decade. There were many more lady science graduates. Even in today's Britain, the engineering profession - in spite of its ubiquitousness and contributions to the country's development - continues to wonder about its status in the minds of politicians and other lay people. Scientists, on the other hand, have been the ones making the discoveries and explaining the world to others. One has only to remember the Cavendish Laboratory at Cambridge in the long heyday of nuclear physics research to appreciate this.

I would argue that the situation in the United States and Canada with regard to a deemed superior position for science in relation to engineering has been a less pressing problem than it has been in

Britain. Yet it has always been there, and remains there today, manifested in a number of ways. For example, the propensity of American scientists - because of their superior domestic research facilities - to win Nobel Prizes is legendary. Nothing so far has succeeded by way of changing the reward system for engineering to 'compete' with the Nobels, although attempts to do so have been made. As I mentioned above, Petroski deals with this in one of his books.

The Nobel factor as it affects the United States is one of those that has allowed the media, generally, to assume that 'science' is responsible for all the good discoveries and events that come to pass. Engineering is only responsible for the disasters. The media have maintained, for example, that scientists sent astronauts to the moon and brought them back. Engineers did! And when Apollo 13 got into difficulties, they said that scientists would fix things to get the astronauts back. Engineers did!

In Canada, there is also a tendency on the part of the media to misinterpret similarly the responsibilities and results of scientific and engineering work, although our Nobel successes have been many fewer and less money has been spent on research and development in relative terms. Also, much of the scientific information used in Canada appears to have been imported from the U.S and other 'scientific' countries. Even the Science and Engineering Hall of Fame at the S&T Museum here in Ottawa includes roughly twice as many scientists as engineers although the two communities are, and have been, about equal in their memberships. And even among the engineers who have been inducted, the practitioners of the profession - who are the majority - have been outnumbered by those honoured for laboratory research. So it would seem to the lay person that engineering is only done in the universities and, especially, in their laboratories.

Petroski has devoted a book - *The Essential Engineer: Why Science Alone Will Not Solve Our Global Problems*. However, in an earlier book - *Remaking the World* - he quotes Theodore von Karman as saying that "the scientist seeks to understand what is: the engineer seeks to create what never was."

Finally.....

The three authors who are the subject of this paper were, or are, basically communicators, one of whose subjects is engineering and its history. Neither Rolt nor Legget took part in the science-versus-engineering debate. However, in *The Essential Engineer*, Petroski says quite clearly at the beginning that science, engineering, invention and technology, separately and collectively, are critical elements in the advancement and protection of society. They are, again, responsible for discovery, design and operation, the separation of the dangerous from the safe, in the home as well as throughout the economy, and even on the battlefield. On the other hand, and especially in regard to science and engineering, he writes that "with an increasing understanding of each other's distinguishing capabilities, scientists and engineers are likely to come together and work as a team that they naturally should be."

Rolt, Petroski and Legget have indeed contributed to this 'coming together.' Yet the need is for

many, many more contributions to the history of engineering by many more communicators. Somehow we engineers have to stop allowing our profession to be taken for granted.

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Sources include:

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Rolt

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Legget