Chapter 9

An Active Retirement

Saudi Arabia

By 1975, the College of Petroleum and Minerals near Dhahran in the Kingdom of Saudi Arabia had grown in size and status to the point where, by a royal decree, it was raised to the status of a university. The student body had expanded from about 60 to over 2,000 full-time students at both the undergraduate and the graduate level. Saudi and foreign students from over 40 countries were represented on the university's large desert-based academic campus. The full-time academic faculty numbered about 400, about half of whom were Saudi with the balance being foreign source academics under contract to the university.

The university looked to what it called a "Consortium of American Universities" for advice and guidance on a broad range of topics relevant to the establishment and operation of a first rank university. Representatives from Caltech, Massachusetts Institute of Technology, Princeton University, Stanford University, and the University of Michigan, among others, were part of the consortium, which met twice a year in Saudi Arabia or in the U.S.[1]

Plans for the following decade included a research institute devoted to applied research and development projects in five areas of specific interest to the Kingdom: namely water, oil, minerals, energy, and standards of measurement.[2]

Therefore, it was hardly surprising that in 1975, when the newly chartered University of Petroleum and Minerals (UPM) began looking for a director for its new Research Institute, it would send its Senior Advisor to the Rector[3] to talk with William Pickering, retiring director of the Jet Propulsion Laboratory (JPL).

Dr. Robert King Hall was "the guy from Saudi Arabia" that "turned up" at JPL, much to Pickering's surprise, about the time that he had concluded that a return to academic life at Caltech after retirement would not be in his best interests. King Hall's offer of a position as the first director of the new Research Institute in Saudi Arabia suddenly offered an intriguing alternative.

For the next several months, while the retirement functions swirled about him, Pickering considered the King Hall proposal. Ultimately, he agreed to accept a contract for two years, beginning in September 1976 when the UPM academic year began, right after the extremely hot months of midsummer were past. Since his function at this point was to be largely planning in nature, he did not see the need to reside permanently in Saudi Arabia. He would do his planning in Pasadena.

Pickering made the first move in his post-JPL career with a brief two week visit to the Research Institute right after the new director took office at JPL in April 1976. Impressed with the university and its infrastructure and, incidentally, intrigued by the cultural overtones that infused every aspect of Arabian academic life, Pickering returned to Pasadena to address the task of generating a long-term development plan for the institute. For this purpose he engaged several colleagues from Caltech and JPL on a part-time basis to help him plan a curriculum and formulate an operating mode for the new institute.

Pickering believed that the Research Institute should play a role for Saudi Arabia similar to that of the great American institutes of technology and his general plan, produced toward the end of 1976, reflected those concepts.[4]

The Research Institute would perform several very important research functions for the Kingdom. For the first time, engineering problems arising within the Kingdom could be investigated at home by a competent research team rather than by calling on experts from abroad. The Research Institute could initiate research activities leading to practical applications of particular value to the Kingdom and the unique institutional and technical resources of the Research Institute would enable it to perform the underlying research work that would lead to new industries in the Kingdom.

Most of the work would be done within the Research Institute, although some would be contracted out. Pickering emphasized the need to retain people with experience in applied research, principally from the U.S., as a resource for the Research Institute in its early years. He suggested criteria by which the institute could select engineering problems for study and criteria by which the approach to selected projects could be evaluated.

Finally, he suggested a management structure that was strongly representative of the flight project structure that he had advocated for so many years at JPL.

Pickering wrote, "Since much of the institute work will be oriented toward projects involving a number of technical disciplines, the staff will frequently be organized into project teams. These teams will be structured into a hierarchy of responsibilities, and their members will be required to work within the structure. Members must understand how to work as members of a team rather than as individual researchers as is usually true in university faculty research."

For the next couple of years Pickering divided his time between the Research Institute in Dhahran and his office in Pasadena, living on the university campus when in Saudi Arabia and living at home during his return visits to California.

It was a lifestyle that he thoroughly enjoyed and he took a great interest in the history, religion, and culture of the Arabic world in which he was now immersed. On one visit he took Muriel with him and together they shared a new and enriching experience of living with other expatriates and faculty in the "Compound" on the campus.

Between commutes to Dhahran and Pasadena he found time, and reason, to deliver speeches and lectures—on space in Saudi Arabia[5] and on "Islam and Oil" in California[6]—and to attend a conference in Lyons, France, on "Space and Civilization."[7]

When his contract with UPM expired in August 1978, Pickering returned to Pasadena and his protégé at the institute, a young Saudi scientist named Abdallah Dabbagh, took over as director of the Research Institute. By then, the institute was developing along the lines that Pickering had proposed in his original planning document. It was now up to the Saudi's to make it work and he had great confidence that Director Dabbagh had the potential to do that. From this point forward he would become a member of the university's Advisory Consortium and give the benefit of his advice once or twice each year as required.

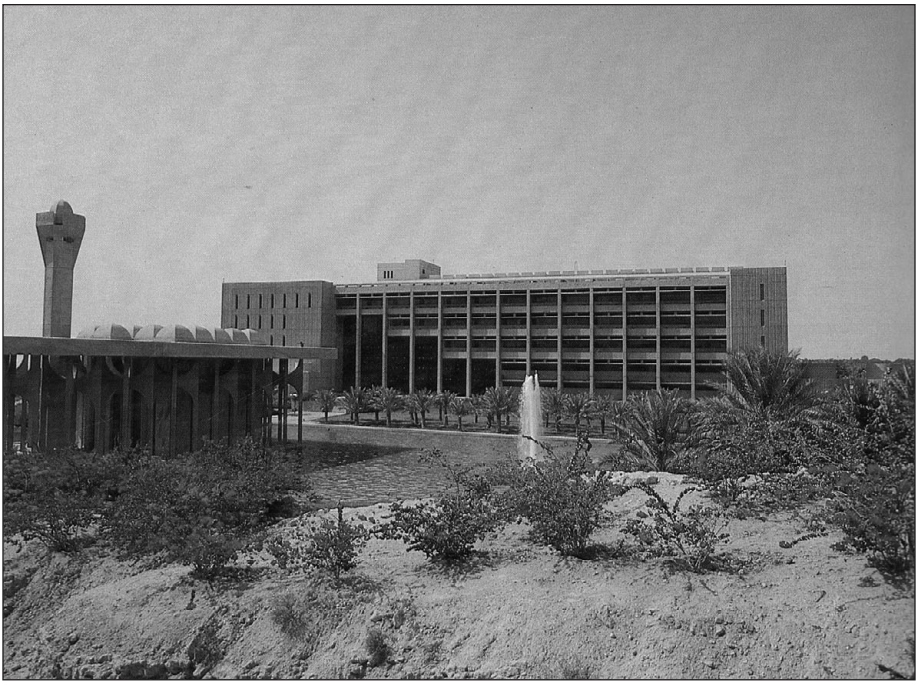
In subsequent years, Pickering returned to Saudi Arabia on several occasions as a member of the Consortium.[8]

Over time, the Research Institute evolved into a vibrant state-of-the-art institution contributing its expertise in a wide spectrum of applied research to problems of prime interest to the Kingdom of Saudi Arabia. Furthermore, all of this had been accomplished within the original organizational structure.[9] William Pickering could justifiably take some considerable satisfaction in that.

Toward the end of his contract, William Pickering presented the university with a proposal to continue his association with the Research Institute as an independent technical consultant rather than as an employee of the university. To that end, he planned to set up a small, high tech consulting firm in Pasadena that would "provide manpower, expert consulting, technical studies, and supporting services to the Research Institute." In providing such support, the firm would, from time to time, draw upon experts readily available to Pickering through his close working relationships with numerous laboratories and educational institutions, most notably JPL and Caltech. The firm would be known as the Pickering Research Corporation (PRC) and would be based in Pasadena.[10]

With this business model in mind and high ambitions for future growth in a broad range of advanced technical areas, Pickering assembled a small group of professional colleagues from JPL and Caltech and with a very modest amount of working capital formed the Pickering Research Corporation: "a nonprofit institution to provide research and development support to the Kingdom of Saudi Arabia," in Pasadena in 1978.[11]

The precise details of the services to be supplied were to be negotiated in the form of a three year renewable contract between the PRC and the institute.



Research Institute of the University of Petroleum and Minerals, Dhahran, Saudi Arabia (Photo: Pickering Collection, Pasadena Museum of History, Pasadena, California).

Pickering's powerful influence in American technology, his extensive network of acquaintances in high office, and the appeal of his cause—build up of American technological influence in Saudi Arabia—assured him of ready access to expertise in a wide field of technology to implement his projects for the institute.

Plans and specifications for a satellite receiving station, an image processing center, and even an oceanographic institute were prepared.[12] Pickering did not limit the interests of the PRC to the Saudi contract, however, but sought other clients in Saudi Arabia and elsewhere. He formed agreements with several well-established high tech specialist firms in U.S. and made efforts to interest the Saudi government in weather modification experiments and environmental monitoring programs in which PRC would act as a facilitator between the Saudi users and the American suppliers.[13]

However, despite his good relations with Dabbagh and a prodigious amount of promotional work for each of these proposals, none of them came to fruition and by mid-1979 when his consulting contract with the Research Institute expired his connection with UPM reverted to his obligations as a member of the Consortium Advisory Board.[14]

Technology Transfer

As his involvement with the Saudi Research Institute wound down, Pickering turned his attention to finding other opportunities for his small corporation. Despite his disappointing experiences in "technology transfer" during his final years at JPL, Pickering retained a deep concern for the viability of the basic concept. As a result, space technology transfer soon became the basis for two new ventures in applied technology—one of them in nuclear power generation and the other in image processing—and both of them ultimately successful.

The Electric Power Research Institute (EPRI) was established in 1973 as an independent, nonprofit organization designed to manage a broad public-private collaborative research program on behalf of the electric utility industry, the industry's customers, and society at large.[15] Pickering and its founder Professor Chauncey Starr were old friends who "knew the ropes" and held a deep respect for each other's experience and accomplishments.

Pickering perceived that the nation's nuclear power generation industry had much in common with U.S. space and missile programs in the areas of reliability and safety and that the power generation industry might well benefit from knowledge of the "lessons learned" and the systems engineering approach that had evolved over the past 20 years in those two major national programs. His argument elicited a receptive response from EPRI and a proposal and contract soon followed. The deliverable was to be a report "documenting the evolutionary development of reliability and safety practices in unmanned and manned space projects and military intercontinental missile projects, over the last two decades." It would describe successes, problems, failures, and how they were corrected to increase the reliability of advanced systems of ever-increasing complexity. It would present the lessons learned in a way that would make it useful to other organizations—such as those engaged in nuclear power generation where high reliability in extremely complex systems was of the utmost importance.

Less than six months after his initial agreements with Chauncey Starr, the PRC completed its contract with EPRI. A few months later the Nuclear Safety Analysis Center published Pickering's report in a formal document for distribution throughout the industry.[16]

Riding on the success of his first contract with EPRI, Pickering followed up with a second proposal to the Nuclear Systems and Materials department of EPRI. Pickering proposed to describe the failure reporting systems then being used by JPL in the Voyager project and by the military in a major space project. These proven techniques, he believed, would have direct application to the nuclear power industry. Again EPRI accepted his proposal and, with help from a slightly different mix of consultants, PRC delivered "on time and in budget."

These were small contracts to be sure, but they served to sustain Pickering's interest in the viability of his tiny corporation, encourage him in the potential for "technology transfer," capitalize on his prestigious name, and provide an impressive front from which he could lever the organization into much more substantial contracts.

Searching for another niche in the field of technology transfer, Pickering turned his attention to computer-aided image processing.

As a consequence of its long experience with the challenges of data processing for its deep space projects, particularly Mariner and Viking, JPL had by then built up a substantial reservoir of unique expertise in the rapidly-advancing new technology of computer-aided image data processing—perhaps the best and most advanced in world at that time—and it was this expertise that it employed to support the Viking Mars mission.[17] Pickering, of course, was well aware of this unique source of expertise and knew exactly where to tap into it—in JPL's Mission Control and Computing Center—for the "technology transfer" he required for his next project.

Pickering planned to apply JPL's image processing technology to the manipulation of Landsat images to produce marketable products of interest to U.S. or foreign agencies engaged in the interpretation of surface imaging data for their particular fields of interest. Such areas of interest included demographics, geodetic or geographic features, vegetation, population, water prevalence, erosion, disaster effects, urbanization, surveying and cartography, agriculture, forestry, desert sand movement, etc., the list went on and on.

Landsat images were already readily available to public users as part of the government move toward commercialization of the Landsat image products.[18] However, to manipulate them and combine them with tabular and other graphic data to meet the specific requirements of individual users, powerful computers, advanced software programs, and peripheral image processing equipment were needed. PRC solved these and other problems by leasing the necessary JPL-developed software programs from the University of Georgia's Computer Software Management and Information Center (COSMIC) and renting time on suitable computers at Caltech's computer center. To manage the Landsat image data processing functions, he persuaded one of JPL's leading software experts to support PRC on a consulting basis as required. Pickering himself undertook to find customers for the esoteric services his corporation could now offer.

Initially, Pickering's Landsat image processing business involved relatively small contracts for U.S. customers who were interested in environmental and demographic problems. However, the returns from this work were not great and barely sustained the effort. From time to time he submitted a number of proposals to potential customers in Kenya, Saudi Arabia, Thailand, and Sri Lanka. In some cases, his proposals included a complete image processing

center with training courses for personnel to manage, operate, and maintain it. None of these proposals, however, was successful.

Then, in March of 1980, as part of the gradually expanding cultural and scientific exchanges with the U.S., Pickering paid a visit to the Peoples Republic of China at the invitation of Dr. Chen Jie, Secretary General of the Chinese Society of Astronautics. He toured numerous academic institutions and manufacturing facilities associated with China's emerging space program and aeronautics industry and gave presentations on Mars, Jupiter, and spacecraft design. His visit proved to be of immense interest to the Chinese engineers and scientists. When he was shown a ground terminal for the Chinese experimental communications satellite, he elicited some discussion of Landsat data processing, a topic that held considerable interest for his Chinese hosts. Sensing some possible business opening in this area, Pickering left his hosts with a draft proposal to supply the Beijing Research Institute with an American-built image processing system.

Summing up his impressions later, Pickering thought that "the places we visited were very backward by our standards; they are short of good instruments, electronics, and computers, and have trouble in developing reliable systems and understanding trade-offs. They also appeared to be deficient in ground tracking and trajectory calculations."[19]

A few months later, Pickering submitted a full proposal from PRC to "design and install an image processing system for the Beijing Research Institute for remote sensing."[20] The price and delivery details were contingent upon obtaining an export license from the U.S. government.[21]

At first, the U.S. government authorities rejected his request for an export license on the grounds that some of the computing equipment and the JPL-developed software contained advanced data processing capabilities that conflicted with government policies regarding the export of U.S. technology to foreign countries. Pickering appealed to his Congressman for reconsideration. In the outcome, Pickering was forced to downgrade the hardware and software to the bare minimum required to manipulate Landsat images and resubmit his application.

Eventually, the long-delayed export license was approved and all of the hardware and software reached the end user in Beijing. In mid-1984 Pickering returned to China for a formal "acceptance and hand-over" ceremony to transfer the image processing system from its supplier, PRC, to its ultimate owner, Beijing Research Institute.

Through all of this frustration, Pickering continued to seek further image processing related business opportunities in China, including a proposal to supply a complete Landsat ground station to the Chinese government. Although none of these ventures was successful he, nevertheless, retained good relations with many top level executives in academic and government circles in that country and made reciprocal visits with them on several occasions in later years.

In the early 1980s, just as the outlook for a successful outcome for the contract with China was in serious doubt and, indeed, the future of PRC appeared doubtful, a colleague from JPL—a chemist by profession—drew Pickering's attention to an idea for an alternative fuel that involved the use of highly compressed pellets of wood waste-sawdust. At the time, the concept had already been patented but attempts to market the product had proved singularly unsuccessful.[22] Pickering picked up on the idea and in due course negotiated an arrangement with the owner of the patent to promote and market the idea through PRC.

Pickering soon began to focus his formidable promotional skills on developing a market for "Frajon pelletized fuels" which, at the time, were being produced very inefficiently, Pickering thought, by a plant in the St. Louis area. He sent out promotional material and made presentations, attended trade-shows, and cultivated contacts in the environment and air quality control industries and government agencies to draw attention to the highly efficient, clean burning, nonpolluting, combustible qualities of "pelletized fuel," but the response was not encouraging. [23]

Then began a remarkable chain of events that, many years later, William Pickering recalled in his inimitable, low-key style. "So about this time I got a call from a man in Idaho who said, 'I've got this pellet manufacturing plant [in Idaho] and it is about to go bankrupt, but it's a good idea and I need some money and I understand you are interested in pellets.' He hoped I would take an interest in his plant and bail him out."[24] But Pickering did not have the capital to intervene and, although he remained interested, the bank eventually foreclosed on the facility.

Acting on his intuition that pelletized fuel held great promise as an alternative source of energy, Pickering assembled a small group of colleagues of like mind into yet another small investment company with the idea of buying the foreclosed manufacturing plant from the bank at a favorable price and turning it into a profitable enterprise. The new company would refurbish the Idaho plant to improve its efficiency and operation and begin producing pellet fuel under the "Frajon" system. Pickering believed that by applying his redoubtable resources in technology to the manufacturing process, he could develop a dominant position in the then-faltering pellet fuel industry. Fortunately, he was able to negotiate an innovative financing arrangement that covered one year of refurbishment work and gave the Pickering group an option to eventually buy the plant under a longer term mortgage arrangement.

Pickering was also fortunate in finding a former JPL colleague with the appropriate expertise, experience, and availability to carry out the refurbishment work at the Idaho plant. Just over a year later, the work was done and the new plant at Sandpoint, Idaho, a few miles from the Canadian border, was in production. In 1983, Pickering renamed the new corporation "Lignetics" after the Latin word for wood and, with himself as Chairman of the Board and a small board of directors comprised of the dozen or so partners, opened Lignetics, Inc. for business.

As Chief Executive Officer, Pickering's devoted his full attention to the day-to-day management of the Idaho plant, promotion and distribution of the Lignetics product, and oversight of the tenuous financial stability of the fledgling corporation. For a man who, a few years earlier, bore ultimate responsibility for the disposition of an assured annual budget numbering in the many hundreds of millions of dollars and a professional staff of thousands, the task must have seemed very ordinary indeed. Yet, he found a personal challenge in it and was happy to employ his formidable intellectual resources toward making it succeed.

High Honors

JPL's spectacular retirement functions in March of 1976 did not represent the end of public recognition for William Pickering's pioneering career in deep space. For the next 25 years, public and professional institutions, national and international, accorded him their highest honors.

In November 1975, Queen Elizabeth II of England had conferred upon William Hayward Pickering the distinction of Honorary Knight Commander of the Most Excellent Order of the British Empire for his "Services to Science." The "Honorary" designation signified his formal, non-British citizenship and entitled him to wear the insignia and append the nominals K.B.E. to his name. Henceforth, his formal address would become "Dr. William H. Pickering, K.B.E." The new title assured him of a permanent place in the ranks of other great New Zealand achievers.

In early June 1976, he and Muriel made a short visit to New Zealand for the investiture, held in this case by the Queen's representative in New Zealand, Governor-General Sir Denis Blundell at Government House in the capital city of Wellington. The short ceremony was followed by an official luncheon at Government House.

Before returning to California, Pickering filled a long-standing commitment to address the 50th anniversary convention of the New Zealand Association of Radio Transmitters—the country's leading amateur radio organization. As New Zealand's most famous living "Ham,"[26] he represented a direct link to the early days of radio at Wellington College. His address was appropriately titled "From Galena to Silicon," a clever reference to the technological advance from early radio based on galena crystal detectors to modern silicon-based transistor radio.[27]

Later that year, in company with his friend Wernher von Braun and highly respected colleague Frederick Terman, William Pickering paid another visit to the White House in Washington, DC. On this occasion, 18 October 1976, he was to receive the National Medal of Science from President Gerald Ford.[28]

This was the nation's highest honor for engineering excellence and its recipients were giants of American technology who would be worthy bearers of the honor that had first been bestowed upon Pickering's mentor, Theodore von Kármán. The National Science Board citation read: "For his leadership

Dr. William H. Pickering, K.B.E., with Sir Denis Blundell, Governor General of New Zealand, following the investiture ceremony in Wellington, New Zealand, 2 June 1976 (Photo: Courtesy of the Pickering Family Trust).

of the exploration of the planets of the solar system and his personal contributions to the theory and practice of soft planetary landings and the collection of data from deep space." Conferred by the nation's highest executive and endorsed by his peers, the National Medal of Science was perhaps the award that he valued most for it represented, unequivocally, excellence in his selected field of endeavor.

Pickering's propensity for international travel showed no sign of diminishing after he left JPL. For the first few years he made numerous visits to Saudi Arabia as part of his relationship with the University of Petroleum and Minerals in Dhahran. On occasion, he extended these trips to include visits to India, Sri Lanka, and Thailand to engage in discussions, generally accompanied by lectures, on the U.S. space program and related topics at universities or technical institutes. He gave papers and lectures in France and Germany for similar purposes.

The Australia and New Zealand Association for the Advancement of Science (ANZAAS), New Zealand Amateur Radio Transmitters (NZART), New Zealand Institute of Management, Center for Advanced Engineering (CAE), Institution of Professional Engineers New Zealand, Royal Society of New Zealand, and the Canterbury School of Engineering were at one time or

William H. Pickering receives the 1975 National Medal of Science for Engineering from President Ford at the White House, Washington, DC, 17 October 1976 (Photo: Pickering Collection, Pasadena Museum of History, Pasadena, California).

President Ford chats with Dr. William Pickering and his wife Muriel at the White House reception following the presentation of the National Medal of Science, 17 October 1976 (Photo: Pickering Collection, Pasadena Museum of History, Pasadena, California).

another honored with personal appearances and presentations by William Pickering. Affording him an opportunity to visit family and friends, institutionally sponsored visits to New Zealand were always an acceptable obligation in those years.

In his retirement years, Pickering's travel within the U.S. was less frequent and far less onerous than it had been in JPL years. Requests for appearances and speeches diminished as NASA's achievements in space no longer held the public interest they once did. In any case there were new personalities at NASA and JPL to talk about the remarkable Voyager encounters with Jupiter and Saturn, Uranus and Neptune, and the new projects to explore the solar system. Gradually Pickering's speeches began to address topics in the field of alternative energy. "Conservation and New Energy Alternatives," "Densified Wood as Domestic Fuel," "A New Energy Resource–Wood," and "Pellet Economics" were examples of this new trend in his thinking.[29]

Throughout his professional life he had maintained a strong connection to the American Institute of Aeronautics and Astronautics (AIAA). Together with cofounder L. Eugene Root, he had brought together the American Rocket

Society and the Institute of Aerospace Science to establish the AIAA in 1963 and he had acted as its first president. He had exercised his considerable prestige and wisdom to formulate the guiding principles of governance that enabled the AIAA to grow to become the world's leading organization of aeronautics and astronautics professionals with an international reputation and active alliances in many European and Soviet countries. His personal contribution to its programs and his powerful influence on the organization were a matter of record.[30]

In 1986 the AIAA recognized William Pickering's contribution to the advancement of aerospace technology with a celebratory dinner at the Caltech Athenaeum and the presentation of its 1986 Aerospace Pioneer award. Among many laudatory messages he received on that occasion were letters from U.S. President Ronald Reagan, California Governor George Deukmejian, National Academy President Frank Press, and many others representing NASA, universities, distinguished scientists, and the country's major aerospace industries.

Pickering's personal satisfaction with the recognition he received as a consequence of his success in public life in these years was tempered by a grievous setback to his personal life in 1992 when, after a prolonged illness, Muriel died of congestive heart failure.

Throughout all of the 59 years that they had been married, William Pickering looked to his wife Muriel for comfort and encouragement when his professional life was difficult and for recognition and approval when it was successful. She had traveled the world with him and shared his introductions to princes and presidents, prominent politicians, distinguished scientists, and dull people aspiring to public recognition by the act of meeting those who had already achieved it. To her husband's public charisma she added her own natural charm, equanimity, and graciousness.

William Pickering bore the loss of his beloved wife with a private grief that those who knew him personally were not party to, for in personal matters he was an intensely private man. He was also a sensitive man, and gentle, and his grief, if not visible, was assuredly palpable. The La Cañada-Flintridge community paid handsome tribute to Muriel's generous contributions to its welfare, law enforcement, beautification, and city improvement activities. She was sorely missed in many ways.

In the months that followed, his daughter Beth helped her father to deal with the loss that they both felt deeply and to adapt to his changed personal circumstances, while Pickering immersed himself in the demands of his new business venture.

Beyond his business interests, Pickering's prominence in the field of aerospace engineering continued to expand as further high honors were bestowed upon him—on this occasion from a European source.

Established in 1992 by European philanthropist Albina du Boisrouvray in memory of her son, the François-Xavier Bagnoud Aerospace Prize was largest

international prize in its field. It was to be administered by the university of Michigan's department of Aerospace Engineering at Ann Arbor, Michigan, where her son had taken his degree in aerospace technology.[31]

The following year the prize selection committee, comprising of aerospace experts from around the world, nominated William Hayward Pickering to be the first recipient of the valuable François-Xavier Bagnoud Aerospace Prize. At his nomination, Pickering commented, "I am honored and delighted to be chosen as the first recipient of the François-Xavier Bagnoud Aerospace Prize and I am a bit overwhelmed by the honorarium [$250,000]. Thank you very much indeed. Being the first recipient is particularly significant to me when I look at the truly international membership of the selection committee."

In a background paper on William Hayward Pickering, Thomas E. Everhart, then president of Caltech wrote, "More than any other individual, Bill Pickering was responsible for America's successes in exploring the planets—an endeavor that demanded vision, courage, dedication, expertise, and the ability to inspire two generations of scientists and engineers at the Jet Propulsion Laboratory."[32]

Pickering's presentation dinner address "Some Reflections on Space Research: The Challenges and the Triumphs," traced the evolution of the U.S. space program from the initial events leading up to Explorer 1 and the early Moon and Venus and Mars missions, through the Voyager missions to Jupiter, Saturn, Uranus, and Neptune. It was, in essence, a retrospective of his own life told on this occasion from the vantage point of history rather than, as in the past, that of a real time participant. "The space program of the 1960s and 1970s was a major weapon in the Cold War," he said. But public support for space was not what it was during the Apollo period.

William Pickering with his daughter Beth Pickering Mezitt, Los Angeles, April 1992 (Photo: Courtesy of the Pickering Family Trust).

"Thirty years later, a fickle public finds space boring. With a recession and an enormous government debt, the cost of space research looks like a controllable area of the national budget that can be sharply reduced. Space flights today seem to be noteworthy only when disaster strikes and the results of space missions seem to be of interest only to a small group of scientists, and are considered by the public to be of no practical value," he said. But we should be looking ahead. He concluded:

> We should regard the ability to explore space and to travel in space as another step in the evolution of mankind, upwards from the cave. My generation took the first steps in space—your generation is the first to have grown up with the knowledge that man has stepped off Earth into the cosmos. You cannot go back—you must move forward. As the Russian rocket pioneer K. E. Tsiolkovsky said almost 100 years ago, 'Earth is the cradle of mankind, but one cannot live in the cradle forever.'

On this occasion, his pleasure was enhanced by the presence of his daughter Beth and her husband and the company of a longtime family friend from La Cañada by the name of Inez Chapman. Inez, it turned out, was destined to play a major role in William Pickering's later life, but for now other matters demanded his immediate attention, foremost among them an invitation to visit the Emperor of Japan.

William Pickering marked his 84th birthday in December 1994 with a few friends and dinner at the beautiful Athenaeum on the Caltech campus in downtown Pasadena. As a Professor Emeritus he enjoyed the deference accorded his visits to the Athenaeum and the ambience of the grand dining hall spoke to him eloquently of the great men of science, many of them his personal friends, who had passed through it in times past.

That evening, Pickering's birthday party also celebrated his selection as a recipient of the 1994 Japan Prize for Aerospace Technologies. The prize carried with it an award of 50 million yen.[33] It was certainly a sufficient cause for celebration.

He was in good company. The other recipient of a Japan Prize that year would be a Dr. Arvid Carlsson a distinguished pharmacologist from the University of Gothenburg, Sweden. Established by the Science and Technology Foundation of Japan in 1985, the Japan Prize demonstrated Japan's commitment to science and technology by honoring those in the international community whose work had contributed to the peace and prosperity of humankind.

For Inez Chapman, now his fiancé and companion on the visit to Japan, the social events in the elaborate program presented, understandably, new challenges. To prepare herself for the task ahead, Inez took time to inform herself about the Japanese royal family and its background and the customs, culture, and recent history of Japan. For his part, Pickering prepared the "commemorative" lecture titled "Space Technology: The New Challenge."

The formalities of "Japan Prize Week" included a joint press conference, receptions at the American and Swedish Embassies, a visit with the prime minister of Japan, the Japan Prize presentation ceremony in the presence of His Majesty the Emperor of Japan, a formal banquet attended by their Majesties the Emperor and the Empress, and commemorative lectures and discussions with an international panel of scientists and technologists.[34]

In his commemorative address, Pickering traced the history of the U.S. space program from its inception, shortly after the debut of Sputnik in 1957, to the present time, reminding the audience that the initial exploration of space was accomplished by both the U.S. and the Soviet Union. Later, other countries, including Japan became involved with the U.S. programs. As scientific questions became more detailed and the missions became more complex, greater opportunities for international cooperation arose.

Pickering expressed his pleasure at the extent to which Japan was now engaged in cooperative space ventures with JPL and expressed the hope that "such cooperation might soon include many other space faring nations as well." In conclusion, he said, "There are worlds that have waited for us for billions of years. The end of the waiting period has begun. We are the first generation to open the doors for the generations to follow."[35]

In addition to the very substantial prize money, William Pickering received an exquisite gold medallion that symbolized the Sun, national emblem of Japan, and the perfection of the circle. "For inspirational leadership in unmanned lunar and planetary exploration, and for pioneering achievements in the development of spacecraft and deep space communications": a fitting tribute from a nation that held such works in high esteem.

For Inez the visit to Japan and the events associated with it had been the experience of a lifetime. It was a difficult act to follow, but follow it she did, by accepting Bill's offer of marriage and celebrating it a few months later with a splendid wedding in the La Cañada Presbyterian Church on 27 July 1994. Bill Pickering's "cup of happiness" was full indeed.

The Emperor of Japan Akihito greets William Pickering and Inez Chapman on the occasion of the Japan Prize presentation banquet, Tokyo, Japan, April 1994 (Photo: Courtesy of the Pickering Family Trust).

The new couple settled down in La Cañada-Flintridge, living in the smaller of the two houses they then owned, and set up a combined household that satisfied the needs of both. For Inez that meant maintaining her piano teaching classes and her community and social activities; for Bill it meant sustaining his business interests in Lignetics and maintaining his numerous obligations to professional institutions such as the Academy of Science, AIAA, and IEEE. It all worked out very well indeed.

The new Lignetics plant in Glenville, West Virginia, had come on line that year. A 1997 news release announced its opening: "Dr. William Pickering, Chairman, Lignetics Inc., informed stockholders in November that the company's new West Virginia pellet fuel manufacturing plant is now in production. This makes Lignetics the largest producer of wood pellet fuel in the United States with combined [three-plant] production of capacity of 200,000 tons per year. This is more than three times the amount of the industry's second largest competitor."[36]

Now, with three pellet plants in production, the Lignetics organization required Pickering's strong direction to make the enterprise profitable. No longer involved with interplanetary space missions and the politics of government/university relations, Pickering's attention was fully engaged with the intricacies of financial statements, production goals, overhead costs and distribution, seasonal inventory, and the price of wet sawdust.[37]

Space Revisited

Despite his business interests, however, William Pickering's interest in deep space exploration had not entirely waned, nor had his name and charisma lost its ability to attract an enthusiastic audience.

When JPL and Caltech celebrated 40 years of space exploration in January 1998 with displays from the past and present and a public meeting at Caltech, the featured speakers were William Pickering and James Van Allen,[38] surviving members of the original Explorer 1 group, and Edward Stone current director of JPL. Pickering spoke of the momentous events surrounding the Explorer 1 event of so long ago, while Stone spoke of the present and the outlook for the future. The three speakers epitomized the amazing progress that spanned the first 40 years of JPL's venture into space exploration. Many of those present were hearing the Explorer 1 story from the legendary participants themselves for the first and, probably, the last time.

Pickering recreated the dramatic events of the launch of Explorer 1—the first detection of the signal from the satellite that signified America's first satellite was in orbit and the tumultuous media reaction that followed the realization that Americans had, at least for the moment, caught up with the Russians in the race for space.[39] In the rush of public excitement it was Explorer 1 versus

Sputnik 1—the U.S. versus the USSR. And there was more, as Pickering was quick to point out. We had science, real and not pseudo, from Van Allen's unique radiation instrument.[40]

The Explorer 1 satellite, conceived and built in haste at JPL, carried with it the hopes and expectations of Cold War America, a country reeling from the shock of the Sputnik demonstration of Soviet superiority. Looking back from 40 years, Pickering could, with some justification, have pointed to the influence of science and technology as a powerful factor for the betterment of humankind, a claim that had been the focus of much of his public discourse in the early years.

"NASA Failures Blamed on Policies," proclaimed the *Los Angeles Times* in March 2000.[41] Suggesting that "NASA took undue risks by working on major space missions too quickly and too cheaply," and this article, like many on that date, referred to the failures, just about one month apart, of two spectacular missions to Mars: the Mars Climate Orbiter and the Mars Polar Lander both of which were the responsibility of JPL. Reminiscent of the early Ranger missions to the Moon, the mishaps had triggered a public outcry critical of NASA and JPL and prompted massive investigations by both organizations in addition to giving rise to a congressional enquiry.

From his modest Lignetics office just across the Arroyo Seco, Pickering empathized with the stress and anguish that the situation brought to the current occupant of his former office at JPL. Forty years earlier he had been in that "hot seat," but now he was on the outside looking in and now, as then, he moved quickly to voice his opinion on the nature of the problem. More than 20 years absence from JPL had not diminished his legacy or dulled his influence within the JPL-Caltech culture. Soliciting opinions from a number of his former senior engineering managers, Pickering quickly produced a position paper titled "Comments on Recent JPL Failures."[42] Referring to the Ranger program and the JPL "culture" that it engendered, Pickering wrote:

> The engineers and scientists of that day were not smarter than they are today . . . but they did some things differently. JPLers were confident, proud of their skills—some even said arrogant. They were cautious, they were meticulous. NASA had difficulty understanding the JPL staffers who were so different from their civil service counterparts.

Pickering described the "loose hierarchical system" that encouraged close communications within the JPL organization and emphasized the importance of "system design and attention to engineering detail" in JPL's success. Since the only real test of a complete (spacecraft) system occurs with the flight itself, "preflight testing must come as close as possible to the actual flight conditions," he wrote.

Pickering believed that to recover from the trauma of losing two Mars missions, JPL must first review its relationship with NASA to restore "both authority and responsibility for technical detail." Changes were also required

within JPL. Perhaps, he surmised, the "matrix" type of organization that had worked so well in the past for a relatively small number of large projects was no longer suited to the current work programs that comprised a larger number of smaller projects. The organizational structure within JPL should be reviewed to find the answer to that question.

Sensitive to the potential value of ideas at all levels within JPL, Pickering asserted that "the internal organization should welcome technical discussions with the younger generation . . . who have sparked the technology boom," and he encouraged the younger generation to "take advantage of the hindsight that the history of NASA and JPL offered them."

Much of Pickering's thinking about NASA and JPL was all too familiar. To the "older generation" it seemed that the problems were the same, only the people had changed. Eventually, as it had done in the past, JPL righted itself and went on to greater glory, leaving behind yet another wrinkle in the rich fabric of Pickering's life experience.

Endnotes

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9 Dabbagh, A. E. "Research Institute Progress Report." Dhahran, Saudi Arabia: King Fahd, University of Petroleum and Minerals, January 1989.

10 W. H. Pickering to Abdullah Dabbagh, Rector, Dharan, Saudi Arabia: University of Petroleum and Minerals, 23 July 1978. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

11 Pickering Research Corporation, "Proposal," 17 June 1978. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

12 Pickering W.H. "Planning documents prepared for the RI, UPM, 1979: Image Processing Center, Oceanographic Institute, Satellite Receiving Station." 30 April 1979. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

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15 See about APRI online at *http://my.epri.com*, accessed 7 July 2007.

16 Pickering Research Corporation, "Space and Missile Reliability and Safety Programs." Nuclear Safety Analysis Center, Doc. NSAC 31, February 1981.

17 Each Viking spacecraft comprised an Orbiter and a Lander. The Orbiters were equipped to make high definition images of the Martian surface from orbit, while the Landers were to carry out their photographic missions from the surface. JPL would provide tracking and data acquisition services including the imaging processing functions.

18 Landsat 1 was launched in 1972 and, over the next two years, transmitted over 100,000 images covering 75 percent of Earth's land surface to the tracking and data receiving center located at the Goddard Space Flight Center in Greenbelt, Maryland. These data were made available to over 300 investigators in the U.S. and foreign countries.

19 Pickering, W. H., "Notes on Visit to China," 27 March to 7 April 1980. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

20 Pickering, W. H., "Pickering Research Corporation Proposal to Beijing Research Institute," 1 August 1980. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

21 Before embarking on this project, Pickering sought unofficial opinions from his connections in the Pentagon and elsewhere in Washington to the effect that such an application from PRC would be viewed with favor by the official authorities.

22 The concept of using pelletized sawdust as a fuel was not new—it had been around for some considerable time. However, the patented "Frajon" process eased the manufacturing process and substantially improved the combusting quality of the product by the use of a special additive that was the subject of the patent.

23 Pickering, W. H., "Demonstration of Frajon Fuel Pellets as a Direct Replacement for Oil in Oil-Fired Boilers." Unsolicited Proposal to the Deputy Director Engineering and Technology, Office of the Corps of Engineers, Department of the Army, 5 March 1981. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

24 Pickering, W. H., Interview with the author, August 2003.

25 As a U.S. citizen, Pickering was not entitled to use the title "Sir," neither in New Zealand nor in any other country. (Honours Secretariat, N.Z. Prime Minister's Department, April 2005.) Although William Pickering never abrogated the privilege, it nevertheless had become common public usage in New Zealand to refer to him as Sir William Pickering.

26 Amateur radio operator.

27 Dougherty, Ian, *Ham Shacks, Brass Pounders and Rag Chewers: A History of Amateur Radio in New Zealand* (New Zealand: New Zealand Association of Radio Transmitters, 1997), p. 227.

28 See online at *http://www.nsf.gov/nsb/awards/nms*, accessed 17 May 2007.

29 From the Pickering Collection, Pasadena Museum of History, Pasadena, California.

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32 Everhart, Thomas E., "Notes for the François-Xavier Bagnoud Aerospace Prize." Ann Arbor Michigan, 7 October 1993. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

33 Equivalent to about $500,000 U.S. at the time the award was made (1994).

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35 Pickering, W. H., "Space Technology: The New Challenge." April 1997. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

36 Lignetics, Inc, "Lignetics Announces New Pellet Production Milestone." *News Release*, 24 November 1997. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

37 The Missouri plant did not meet the company's expectations and was closed the following year.

38 Wernher von Braun the third member of the original group credited with the success of Explorer 1 had passed away in 1977.

39 Pickering, W. H., "40th Anniversary of Explorer 1." January 1998. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

40 Ill health prevented James Van Allen from traveling to Pasadena but he sent a video recording in which he told of his discovery of the now-familiar bands of intense radiation that surrounded Earth and now bear his name. Van Allen, James A., "Text of statement by James A. Van Allen for a gathering at Caltech on January 31, 1998." January 1998. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

41 McFarling, Usha Lee, "NASA Failures Blamed on Policies," *Los Angeles Times*, p. A3, 14 March 2000.

42 Pickering, W. H., et al., "Comments on Recent JPL Mission Failures." 10 March 2000. In the Pickering Collection, Pasadena Museum of History, Pasadena, California.

Chapter 10

Full Circle

Full Circle (1994–2004)

At age 90, William Pickering was an imposing figure. Tall, slim, and of upright bearing, he walked purposefully, unaided by cane or walker. He dressed plainly but well, informally or otherwise, and always with good taste. His graying hair, sparse but not bald, was always neatly combed in place and his facial features, unadorned by beard or moustache, were clear, healthy-looking, and well shaped. Piercing blue eyes beneath a prominent forehead imparted an air of authority to his presence that was a defining characteristic of his persona. Thin lips and a small, tight mouth gave his speech a clipped incisiveness that complemented his deep resonant voice and residual "Kiwi" accent. His sight and hearing were good and his memory and power of recollection were awesome. He did not smoke but enjoyed whisky, beer, or wine in moderation as the social occasion demanded. In conversation, he often summoned a tight-lipped Mona Lisa-like smile but seldom laughed outright, tending to "chuckle" deep within his throat when amused.

He bore his many honors like the elder statesman of science that, by that time, he really was. He possessed a personal charisma that endeared him to audiences wherever he went and was equally at home in the company of presidents or princes; Congressmen or kings; and preeminent scientists or adoring school children. The media loved him for he had the knack of pitching his remarks to the level of understanding of his listeners and he was never at a loss to answer a question. "Let me reflect on that . . ." he invariably began. The media called him, with justification, the "gentle giant of science." Among his peers throughout the world he engendered the greatest respect and among those he led at JPL he generated a loyalty that never waned. He was a natural leader and knew no other way to conduct the business of his life.

The new century found William Pickering taking a much less active role in his business affairs. The unprofitable Missouri plant had since been closed and the two remaining plants were operating profitably. A younger man who had been with the company since its inception carried the title of Chief Executive Officer and now directed the company's regular business from new headquarters in Idaho. Pickering retained the title of Chairman of the Board of Directors and maintained a modest office in Altadena just across the Arroyo Seco from JPL. There he periodically convened meetings of his stockholders and dealt with a continuous stream of daily business associated with his remaining professional interests. Although the company was growing slowly, Pickering felt that it faced an uncertain financial future that might, in the not too distant future, necessitate its sale to satisfy shareholder expectations for a more timely return on their investments. But for now, he was content to let events take their course and look to others to deal with the situation as it evolved.

Although Pickering's association with professional societies in the field of aeronautics and astronautics grew tenuous in his later years, the institutions that he had served so well in his earlier years—founder in one case, president in most others—did not forget him and they sought to demonstrate their appreciation with the bestowal of their highest awards.[1]

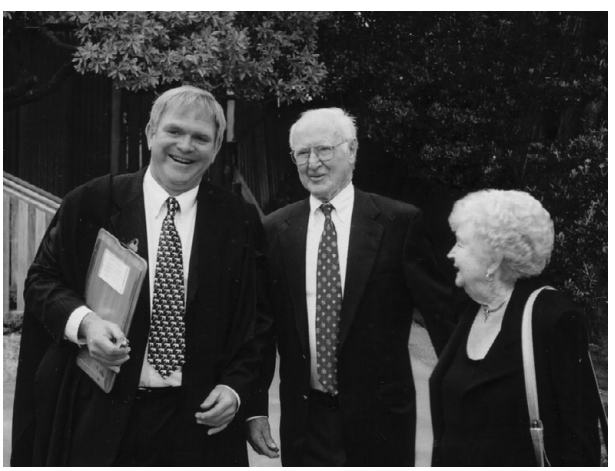
"In recognition of a distinguished career that pioneered and shaped the exploration of our solar system and, for extraordinary contributions to engineering and science," read the citation for the year 2000 Guggenheim Medal awarded to William Pickering by the American Institute of Aeronautics and Astronautics at its Honors Night banquet in May 2001. The John F. Kennedy Astronautics Award for Public Service is given to an individual who "has made an outstanding contribution by promoting the nation's space programs for the exploration and utilization of outer space," stated the American Astronautics Society in their 2002 award of this distinction to William Pickering. Accompanied by his wife, Pickering attended the award banquets with obvious delight and accepted the accolades with graciousness and inevitably, with an appropriate speech of acceptance.

Less now a bully pulpit for the future of space exploration, institutional reform, and the deployment of space technology for the betterment of humankind, Pickering's occasional speeches turned back to review what had gone before and how he had been involved in the opening of the Space Age. The speeches were shorter and less technical and, for audience impact, relied largely on stunning slide images from the Viking and Voyager missions to Mars, Jupiter, and Saturn rather than a mind-bending reiteration of what were, at the time, astounding facts of the new technology of space exploration. An address to the World Space Congress[2] on early exploration of the solar system in October 2002, and an opening address to an international telemetering

conference[3] in Las Vegas in October 2003 were instances of this trend and were in fact to be among the last of his public presentations.

Like Pickering himself, those who had been old enough to recognize the threat of the Soviets' Sputnik coup and experience the tensions of the Cold War era had aged, and indeed many had been replaced by a new generation of young technologists for whom space was a given—an established fact—a point of departure for even greater achievements in space exploration. The space pioneers, Pickering foremost among them, were immortalized in many places throughout the country where feats and facts and fiction related to America's achievement in space provided attractions for educators, tourists, and, occasionally, fanatics. Pickering's portrait, achievements, and biography occupied prominent positions in the exhibition areas of such places as the International Aerospace Hall of Fame at Alamogordo, New Mexico, site of the first V2 rocket tests in U.S. and the International Aerospace Hall of Fame in San Diego, California, a key center for American aerospace development from early aircraft to modern booster rockets.

Pickering fulfilled a long-standing obligation when he returned to New Zealand yet again in March 2002, to attend a rededication ceremony for the recently restored Gifford Observatory at Wellington College. He was to be the primary speaker and guest of honor. It was an obligation that he gladly accepted. "Uncle Charlie" Gifford had been the resident mathematics teacher at the College during Pickering's formative years of 1923 to 1927, when he was a pupil at the school, and he had played a major part in establishing young Pickering's general interest in mathematics and science—physics and astronomy, in particular. He forever carried a debt of gratitude to the memory of Charles Gifford, whose gift to the school of a 5-inch Zeiss refractor telescope had made the wonders of astronomy a reality for generations of students like William Pickering.



Headmaster Roger Moses greets Dr. and Mrs. William H. Pickering at Wellington College, Wellington, New Zealand, March 2002 (Photo: Neely Collection, Wellington College Archives).

Local media reported widely on the presence of Dr. Pickering and his wife in Wellington and the Pickering's visit very quickly expanded into a frenzy of public appearances, talks, and lectures

interspersed with a public lecture to a crowded Town Hall,[4] the dedication for the Gifford Observatory,[5] and an address to the plenary session of the Institution of Professional Engineers New Zealand (IPENZ).[6] Newspaper and television interviews vied for time with the city's distinguished visitor. Fuelled by the attraction of his reputation and enhanced by his royal nominal (K.B.E.), his popularity in New Zealand could hardly have been greater.[7]

The following year, in March, the final details of John Campbell's plan for the Rutherford-Pickering Memorial in Havelock fell into place, and a date for the dedication ceremony was set. Accompanied by his wife and daughter, Pickering returned to New Zealand once more, this time as the guest of honor for the celebrations in Havelock.

Return to Havelock

Late summer in the Marlborough Sounds can be an enchanting time. The days are long, clear, and sunny. Gentle winds rather than the howling gales that roar through Cook Strait at other times of the year keep the temperatures in a comfortable range. The steep hillsides that cradle the long arms of sparkling water connecting to the sea are greened by the occasional overnight rain. Around Havelock, a profusion of wild flowers are in bloom and dairy cattle browse the lush green pastures. The flood of summer tourists has subsided and the smell of saltwater hints at Havelock's historic connection to the sea. Saturday, 15 March 2003 was just such a day—picture postcard perfect.

Along the main road that passes directly through the tiny township, several of the few shops that comprised the business area of Havelock displayed hand-printed signs reading "Welcome home Sir William" and "Havelock honors Sir William Pickering" and from the town hall in the center of town flags hung listlessly in the bright morning sunshine.

Up at the modern Havelock Primary School,[8] a short walk beyond the town, school children began assembling early for this was to be a special event—Havelock's own, world-famous scientist was coming to town, to their school, to talk to them.

In a short speech, matched perfectly to his juvenile, but very well-informed audience, he told stories of his school days at the old Havelock School and spoke of the wonderful adventures in space that had been the main part of his life. He admired the splendid murals and displays of the solar system that the students had prepared for the occasion. He encouraged them to study hard and to keep learning, saying that "what you do at school is important for what you do after school." Afterwards he patiently answered questions, signed autographs, and planted a tree to his memory. And then it was time to go on to the next event.

Along the main street, the tooting of car horns and shouts of welcome signaled the arrival of the guest of honor. Riding in an antique Ford Roadster, William Pickering, accompanied by his wife Inez and daughter Beth, swept into town—the ladies waving graciously to the astonished bystanders, the guest of honor gallantly acknowledging their welcome with a nod and a smile.

Following speeches from officials representing civic and Maori interests, Pickering spoke of his pride at being honored, along with Lord Rutherford, by the splendid memorial. He said:

> This memorial will be seen by many who will wonder who these people were . . . and perhaps come to believe that if two boys from Havelock can become world figures, perhaps they too, should strive to develop their talents. . . . Each in our own way, we exemplify man's insatiable curiosity to learn about his universe. Rutherford and I happen to have been in the right place at the right time to be able to use the talents we were blessed with to contribute to the encyclopedia of knowledge that describes the universe.

Saying that we now live in an era of instant communications that allow ideas and leadership to develop in even the smallest parts of a community, Pickering asked, "Who knows which of you will make a singular contribution to mankind and which of you will have a message for the world?"[9]

At the appropriate time and, somewhat jostled by the press of curious spectators, photographers, TV crews, and news reporters, Pickering cut a ribbon to unveil the memorial panels and, to a burst of polite applause, the Rutherford-Pickering Memorial was declared open. A group of school children sang "God Defend New Zealand," New Zealand's national anthem, and the ceremonies closed with a magnificent New Zealand country luncheon in the nearby town hall. William Pickering's boyhood friend Ulrich Williams, now also 94 years of age, joined him at the luncheon and the two old friends enjoyed reminiscing about times long past, while both savored the wonderful food that, obviously, included the local seafood delicacy of greenshell mussels.[10] Except for a curious few who lingered to read the panels, the crowd dispersed and Havelock township went back to sleep.

Its moment in the glare of public attention had passed but now, where for many years a shipwreck memorial had stood largely ignored and neglected, a beautiful new edifice testified to a remarkable coincidence that linked this remote spot in faraway New Zealand to seminal events in the world of modern science.[11] The event was widely reported in New Zealand in both press and television news programs.[12]

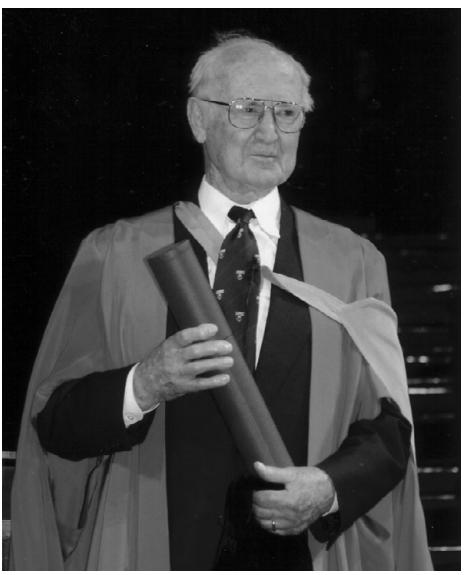
As a complementary part of the celebrations, the University of Canterbury had planned a big public function for its illustrious former student. Although he had spent only one year at the university prior to moving to California, he had developed close ties with the faculty in recent years. Now it planned to

confer the honorary degree of Doctor of Engineering upon him at a formal, public graduation ceremony to be held in the Christchurch town hall the day following his arrival from the celebrations at Havelock.

In New Zealand, the Pickering name on a program inevitably guaranteed a full attendance and this was no exception. For this occasion the civic auditorium was packed with interested public, students, and enthusiastic young people who had come to hear the great man speak. The graduation ceremony was conducted with traditional "pomp and circumstance." Heroic music from a grand pipe organ heralded the arrival of the faculty in full academic regalia who, led by University Beadle Professor John Campbell, escorted William Hayward Pickering to the platform.

In the course of the proceedings the Chancellor lauded William Pickering, describing him as "New Zealand's greatest gift to America." The Vice-Chancellor called Dr. Pickering's respect for science and engineering and his commitment to furthering knowledge through scientific research "inspirational." In his oration, the Dean of Engineering described Dr. Pickering's career in glowing terms and praised his continuing interest in New Zealand and New Zealand students undertaking graduate study at Caltech.[13] "The University is proud to be able to honor one of New Zealand's great engineer/scientists," he said.

The Chancellor then conferred the Doctor of Engineering degree upon him and Dr. Pickering, now attired in the appropriate academic cap and gown, rose to deliver his speech of acceptance. It was quite brief and quite simple. He first paid tribute to the quality of New Zealand education that had enabled him to qualify to enter Caltech. He felt deeply honored by the award of this degree noting that "there is something very special in being honored in one's original home." He traced his involvement in the U.S. space program from the first Explorer Earth satellite to the latest Cassini mission to Saturn. Then, he showed a selection of spectacular slides covering the best of the planetary missions and commented



Dr. William H. Pickering, K.B.E., receives the Honorary Doctor of Engineering degree from University of Canterbury (Photo: Duncan Shaw-Brown, reproduced with permission from the University of Canterbury, New Zealand).

on each. "This space business has been very exciting and it's solved a lot of questions, but it looks like there's a lot more work to be done," Pickering concluded. It was a great performance. At the end, he received a standing ovation from the enthralled audience.[14] Simple and direct, that was what the media and the public loved about his talks.

Back in La Cañada, life for William Pickering resumed where it had left off, almost as if the circumstances of his "return to Havelock" had never happened at all. But they had and reverberations from the recent events in New Zealand would continue to echo through his life for the rest of the year.

The Royal Society of New Zealand, in which he held the rank of Honorary Fellow, decided to strike a new medal to be awarded annually to an exceptionally gifted engineer or technologist. It was to be named the Pickering Medal and would carry his profile on the obverse side.

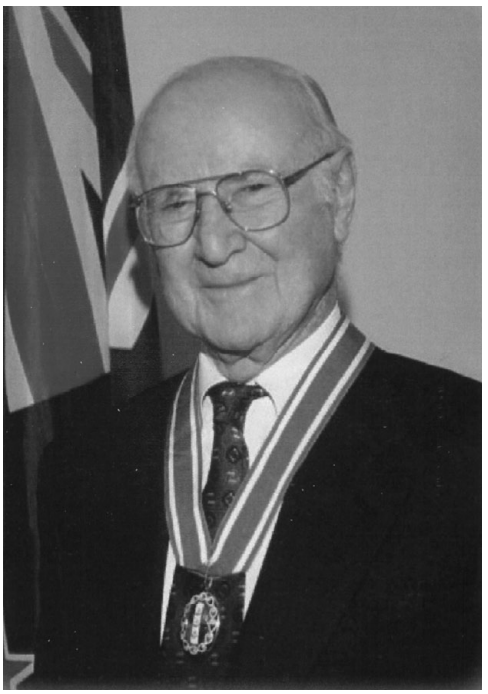
A few months later, a Caltech friend who had recently returned from a tour of New Zealand sent Pickering a photograph of an advertisement carried on the back of a Christchurch city bus. Produced by the University of Canterbury it featured William Pickering in full academic regalia with the caption "Greatness in the Making." The obvious innuendo suggested by his image on the "back of a bus" was not lost to Pickering's sense of humor.

On a hot, smoggy June day in 2003, Bill Pickering was having lunch with this author at his home in La Cañada. Inez had prepared a beautiful lunch—smoked salmon, scrambled eggs, and fresh rolls—and the chardonnay was cool and crisp and the conversation was lively. We were discussing the details of a possible book about his life and times when the phone rang. Bill took the call at the table and suddenly the mood turned serious. It was the New Zealand Ambassador to United States calling to inform William Pickering that he had received the honor of Honorary Member of the Order of New Zealand, in the recent (June 2003) Queen's Birthday Honors List.

New Zealand's highest civic honor, the Order of New Zealand, was limited by statute to 20 living members at any one time. The citation read "In recognition for services to New Zealand." It was a unique honor that William Pickering would value highly and a fitting tribute from his native country where his achievements were held in such high regard.

Letters of congratulation, including one from the Prime Minister, poured in from all over New Zealand. Under the headline "Queen's Birthday Honours; Space Pioneer Honoured Again," one of New Zealand's leading newspapers reported the award of the country's top honor to William Pickering, describing him as "one of New Zealand's most famous living scientists."[15]

Rather than require him to return yet again to New Zealand, Ambassador John Wood presented William Pickering with the Order of New Zealand at the Embassy in Washington, on 22 September 2003, in the presence of a small group of family and friends representing Caltech, NASA, and JPL.



Dr. William H. Pickering, O.N.Z., K.B.E., was made an Honorary Member of the Order of New Zealand. Los Angeles, California, September 2003 (Photo: Pickering Family Collection).

The great public interest engendered by Pickering's visit and his subsequent Order of New Zealand award, prompted an enterprising young New Zealand film producer to approach him toward the end of the year with a request for an on-camera series of interviews on location in and around JPL. It was to be part of a documentary on New Zealand's relationship to the Space Age. Pickering readily agreed and the filming took place at JPL a few months later.[16]

Around the same time, this book project began to capture Pickering's interest as the manuscript took shape. The lengthy, in-depth interviews had been completed and by March 2004 when the author began delivering the opening chapters for his approval, Pickering took great pleasure in the detailed reconstruction of his early life and in sharing the material with Inez. Ever the old egotist, he was clearly looking forward to seeing his name on the shiny jacket of a new book—"perhaps a bestseller, perhaps a movie someday," he joked.

And then, quite suddenly, he was gone.

William Pickering died of pneumonia at his home in La Cañada-Flintridge, California, on 15 March 2004, by a remarkable coincidence one year to the day after the dedication ceremony for the memorial in Havelock, New Zealand.

His untimely death sent shockwaves around the world and was reported widely at home and abroad. Wherever his accomplishments in space had been recognized throughout the last half of the 20th century, dozens of newspapers, journals, and magazines published accolades to his brilliant career.

More than any Other . . .

A few days later, family, friends, and colleagues from many walks of life gathered in the beautiful Beckman Auditorium on the Caltech campus in Pasadena

for a quiet memorial service to pay a final tribute to William Pickering. There, amid the palm and olive trees, alcoves and columns of the stuccoed Spanish-style buildings that he loved so well, he would have felt completely at home. New Zealand Consul General Darryl Dunn, JPL Director Charles Elachi, and former colleagues joined Caltech President Emeritus Thomas Everhart in eulogizing William Hayward Pickering as they remembered him. All perceived the character of the man in their individual ways; all praised his gentleness, avid determination to succeed, his concern for humanity, and, above all, they praised him for his integrity and adherence to the fundamental principles of scientific enquiry. "In his personal life as in his professional life in the world of space science and technology," they said, "William Pickering had set standards of excellence that would be an example for all that would surely follow."

On an earlier occasion recognizing William Pickering's achievements, President Emeritus Thomas Everhart had written, "More than any other individual, Bill Pickering was responsible for America's success in exploring the planets—an endeavor that demanded vision, courage, dedication, expertise, and the ability to inspire two generations of scientists and engineers at the Jet Propulsion Laboratory."[17]

That tribute still stood. William Pickering would have liked that—it was epitaph enough.

Endnotes

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Chapter 11

In Retrospect

It is timely now to consider how history should regard William Hayward Pickering and to consider by what criteria and what yardstick his contribution to society should be measured. Should he be judged by the standards of his times or the standards of the present, by his contribution to society, or to science or human knowledge, by his contribution to his native country or his adopted country or the world in general? And what is his legacy to the age of space in whose gestation and birth he played such a prominent part?

William Pickering first came to the attention of the world in January 1958 when the media triumphantly announced the successful launch of Explorer 1, the American response to the Soviet deployment a few months earlier of the first Earth-orbiting satellite Sputnik. Along with Wernher von Braun and James Van Allen, William Pickering shared the limelight and the accolades. In that instant of time the Space Age was born and with it the professional reputation of William H. Pickering.

Under Pickering's leadership, JPL designed, built, and dispatched NASA's first Ranger spacecraft to take close-up pictures of the surface of the Moon. Building on its Ranger experience, JPL sent the first spacecraft to Venus and, as technology improved, to Mars. The scientific data returns from each successive mission greatly increased our understanding of the composition and dynamics of the solar system and its planets. When he retired as Director in 1976, Pickering had presided over NASA-JPL's missions to the Moon, Venus, and Mars and laid the basis for the fabulous Voyager Grand Tour of all the planets that would sound the praises of NASA-JPL for the next 25 years. Not all of the missions were successful, but Pickering accepted the responsibility that devolved from his position as Director, regardless of the outcome.

Why did the achievements for which the media gave him credit make him so outstanding and so unique? By current standards, when satellites and planetary missions are relatively commonplace, he would be judged as "one among

many." But for those few years of 1957 to 1977, missions to the planets were not commonplace; they were unique in the extreme and drew an enormous amount of worldwide public interest. Judged by the standards of that time in the field of space he was indeed "one among few."

While Pickering would be quick to acknowledge that he was merely a part of the NASA-JPL team that conceived and carried out these exquisite missions to the Moon and planets, the public preferred a hero before a team and Pickering had the restrained charisma of a public hero. Rightly or wrongly, he became the chosen one to be credited with leading the U.S. struggle with the Soviets for eminence in space, specifically in the field of planetary exploration.

This perception of Pickering as a pioneer in deep space was enhanced by his extensive agenda of public speaking. Pickering delivered carefully crafted presentations, aided in many cases by a very competent speechwriter, to give him a gravitas that extended well beyond the field of advanced aerospace engineering that made such missions possible.

Among the international community of nations interested in the field of deep space exploration, he came to represent a standard of excellence and a level of achievement that, emboldened by the awesome resources of NASA and enhanced by the enviable reputation of Caltech, none could emulate. For his native country he became an icon, a role model of the country lad whose basic New Zealand education led him to the esoteric field of cosmic ray physics, and, eventually, to a leading part in opening the new age of space.

Many of his colleagues perceived an obverse side to Pickering's attractive public persona that was abrasive, stubborn, and self-centered. Historians observed that the hubris that JPL staff, Pickering included, frequently exhibited toward their counterparts at NASA Headquarters were well-founded.

But Pickering was very loyal to his senior staff that, in reality, formed the main engine that drove the Laboratory. They were the real source of power and innovation at JPL. Pickering knew that and he realized that they resented interference, direction, and judgment from their civil service administrators at NASA who some perceived as less than worthy of the position of authority they claimed. To keep his people focused and productive under the JPL umbrella, Pickering believed that he had to "protect" them from NASA, and to preserve the freedoms associated with the university campus-like environment that attracted them to JPL in the first place. In doing so, he invoked the wrath of NASA and came very close to terminating his career at JPL.

It was not all one-sided, however, and the NASA-JPL working relationship, abrasive though it was, did little to impair the successful progress of NASA's planetary programs. As a former NASA Associate Administrator remarked, "It took strong efforts by men of good will on both sides to make it work."

Apart from several papers dealing with his cosmic ray research at Caltech, Pickering published relatively few scientific papers. Most of what he did at

JPL prior to its becoming part of NASA was classified and not available for public dissemination. However, as Director of a new NASA facility, he used the prestige of his position to give public expression to his ideas, opinions, and experience and to further the public and government interest in space.

To this end, he delivered a great many public lectures where his natural aptitude for public speaking, dramatic subject matter (space exploration), sense of humor, down-to-earth demeanor, and unique New Zealand accent endeared him to the media and charmed audiences wherever he went. By contrast, on a person-to-person level he was rather intimidating. The depth of his technical and scientific knowledge, complemented by his extensive practical experience, penetrating and logical thought processes, sparse conversation, and direct manner made him a formidable manager for his senior staff and a powerful adversary for his NASA detractors.

Writing on the career of William Pickering in 1965, a leading New York newspaper described his efforts to encourage public and government support for the nation's space program and his publicly expressed confidence in the nation's ability to overcome the apparent Russian dominance in space occasioned by the 1957 Sputnik affair as his "greatest contribution." A similar thought was reflected in the (1993) remarks of a former Caltech president, "More than any other individual, Bill Pickering was responsible for America's success in exploring the planets."

For the U.S. space program, his legacy is exemplified by these two opinions written independently 28 years apart, one at the beginning and the other at the end of his career. It might be argued that others could have led the U.S. into deep space with equal success. Perhaps, but the fact remains that they did not and he did. In a word, he was the right man at the right time.

For humankind's first venture beyond the constraints of our home planet, he led the team that led the way. "To be first" was ever his credo.

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A Note on Sources

Much of the background material for this account of the life of William H. Pickering is based on Pickering's interviews with the author extending over the 15-month period that preceded his death in March 2004. The tapes and transcriptions of these interviews are referred to in the text as "Interviews with Author" and are included with Pickering's personal papers held by the Pasadena Museum of History in its William H. Pickering Collection. The personal papers span Pickering's life from childhood in New Zealand through the end of his business life in the U.S.

Additional material on the New Zealand aspects of Pickering's life may be found in the Archives at Wellington College, and in the Pickering Collection at the Alexander Turnbull Library in Wellington, New Zealand.

The extensive JPL Archival holdings on William H. Pickering cover his professional life as director of JPL, from 1958 through his retirement in 1976. They are arranged in several numbered, processed collections, as follows:

Pickering (William H.) Collection, 1958-1976, JPL214

Pickering (William H.) Committee Organizations Collection, 1962–1970, JPL140

Pickering (William H.) Office File Collection, 1955–1976, JPL186

Pickering (William H.) Publications Collection, 1932–1971, JPL133

Pickering (William H.) Records, February 1970 to March 1989, JPL3

Pickering (William H.) Speech Collection 1955–1975, JPL181

Pickering (William H.) Speech Reference Collection, 1959–1974, JPL187

Available online at *http://beacon.jpl.nasa.gov/Find/FindHistorical/archlist.htm*

Additional archival material relating to William H. Pickering can be found in the JPL Archives History Collection online at *http://beacon.jpl.nasa.gov/Find/FindArchivesCat.htm*

The Archives of the California Institute of Technology also contain an extensive processed collection of the papers of William H. Pickering spanning the period 1941 to 1970. Titled "The Papers of William H. Pickering (1910-present)," the collection was processed by Laurence M. Dupray and Joy A. Pinter in June 2001. The collection is arranged serially as follows:

Series I General Correspondence

Series II Jet Propulsion Laboratory (includes Caltech and NASA-related items)

Series III Conferences

Series IV Professional Organizations

Series V Committees

Series VI Awards and Miscellaneous

Available online at *http://archives.caltech.edu/collections.cfm*

The institutional business of JPL and its interaction with NASA and Caltech under the direction of William H. Pickering has been well documented by Clayton R. Koppes in his detailed history of JPL, "JPL and the American Space Program," Yale University Press, 1982. Where necessary, the narrative draws on Koppes' distillation of archival material rather than the primary sources to illustrate significant events in the history of the laboratory during the Pickering years.

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