

# MEMORIAL RESOLUTION WOLFGANG K. H. PANOFSKY

(1919-2007)

Wolfgang K. H. Panofsky, Stanford Professor and Director Emeritus of the Stanford Linear Accelerator Center, died on September 24<sup>th</sup>, 2007 at the age of 88. Known all over the world by his friends and colleagues as “Pief”, he had an illustrious career in Physics, International Science, and Arms Control, spanning more than six decades. Pief had a prodigious intelligence, was a first-rate scientist, a visionary, an excellent administrator, and a wonderful and compassionate human being. Nobody who got to know him will ever forget him. On the last day of his life, he still came to work at SLAC, and had several meetings with colleagues, before he drove himself home and died of a heart attack.

Born in Berlin on April 24, 1919, Pief was the second child of Erwin and Dorothea Panofsky. A world-renowned art historian, Erwin Panofsky accepted a faculty position at the University of Hamburg in 1920, and the family lived there until 1934. Pief and his elder brother Hans were both very bright children but unlike their artistic parents, they developed an early interest in science and technology.

Soon after the Nazis came to power in 1933, most professional German Jews lost their jobs and other civil rights, and the family had to leave Germany. Erwin Panofsky secured an appointment at Princeton University, where he settled with his family in 1934. When Pief arrived at Princeton at age 15, his parents were able to enroll him and his brother directly into the university, temporarily on probation. Probation, however, was soon lifted since they were both excellent students. To their classmates who considered them somewhat as “oddballs”, they were Piefke and Paffke (German cartoon characters), and the name, “Pief” for short, stuck with him for the rest of his life. Pief’s Princeton education offered him many opportunities, including the fact that his father befriended Albert Einstein at the Institute of Advanced Studies, and since neither one could drive, Pief became their occasional chauffeur at age 16!

After graduating from Princeton in 1938, Pief received an offer from Robert A. Millikan to join Caltech as a graduate student, with a teaching assistantship. He accepted and did his PhD thesis under Prof. Jesse DuMond, performing a precision measurement of the ratio of Planck’s constant to the charge of the electron, and also getting acquainted with the boss’ eldest daughter, Adele. The Japanese attack on Pearl Harbor happened in the middle of this, and in 1942, Pief got his degree, was teaching classes to U.S. generals in electromagnetic theory, started defense work on an acoustic device called a Firing Error Indicator (FEI), got his U.S. citizenship, and married Adele.

Two years later, Pief’s work on the FEI -- which measured shockwaves from supersonic bullets -- attracted the attention of Luis Alvarez and J. Robert Oppenheimer who were interested in measuring the yield of nuclear detonations for the Manhattan Project. As a result, Pief was invited to work at Los Alamos as a consultant, and a year later a shock wave detection device he developed was supposed to be tested by him with others on July 16<sup>th</sup>, 1945 from a B-29 airplane over the Trinity plutonium bomb test in Nevada. Although the shock wave test did not take place as planned because of weather problems, similar gauges were later used over Hiroshima and Nagasaki. It is clear that Pief’s awareness of the gravity of these events shaped many of his actions for the rest of his life.

## Physics Career

After WWII ended, Pief joined Luis Alvarez at the University of California Radiation Lab (UCRL) directed by E. O. Lawrence, to work on proton linear accelerators (linacs). He rapidly went on to successfully lead the group, which designed and built the 32 MeV, 40-ft drift-tube proton linac, and participated in seminal particle physics experiments with this linac and the 184-inch cyclotron. At this time he also wrote his well-known textbook on “Classical Electricity and Magnetism” with Melba Phillips.

By late 1949, following the first Soviet nuclear test on August 29 and Truman’s decision to proceed with the construction of the hydrogen bomb, Lawrence and Alvarez decided to contribute to the project by finding ways to produce tritium or breed plutonium with large quantities of neutrons. To do this they proposed a proton and deuterium linear accelerator named the Materials Test Accelerator (MTA). Its first stage (87 ft. long) was eventually built at an abandoned naval air station near Livermore (which later became Lawrence Livermore National Laboratory). Somewhat reluctantly, already having second thoughts about further nuclear weapons, Pief worked on the microwave cavities for the project. But other political events caught up with him. The University asked all employees to sign a Loyalty Oath which, in Pief’s words, required them to “affirm their lack of Communist contamination”. Pief signed the oath but when he found out that others who had refused to sign it were threatened with dismissal, he became very upset and decided to resign from the lab. Learning of this, Stanford Professors Leonard Schiff and Felix Bloch enticed him to come to Stanford.

In early July of 1951, Pief joined both the Stanford Physics Department and the Microwave Laboratory. He immediately got involved with the MARK III linear accelerator whose conception and early construction had started under the leadership of physicist William W. Hansen, with help from the inventors of the klystron, Russell and Sigurd Varian. Hansen died prematurely of lung disease in May 1949, but the construction of the MARK III continued successfully under the leadership of Ed Ginzton. The success of the MARK III electron accelerator, both as a machine eventually yielding a beam energy of 1 GeV and as a rich source of particle physics research, inevitably led to the “next step” question. Numerous discussions were started by Robert Hofstadter with Pief, Ed Ginzton, Leonard Schiff, Richard Neal and others. A series of meetings were organized to come up with a proposal, the first of which was held in the evening of April 10, 1956 at Pief’s home. The effort was originally called Project M for “Multi-BeV” or “Monster”, a formal “Proposal for a Two-Mile Electron Accelerator” was published in April 1957, and submitted simultaneously to the Office of Naval Research (ONR), the Atomic Energy Commission (AEC) and the National Science Foundation (NSF). When Ed Ginzton, who had directed the Project M research phase, resigned from Stanford to assume the leadership of Varian Associates, Pief became director of the project, now known as SLAC, and successfully used all his persuasive powers to get the project funded at Stanford. President Eisenhower endorsed the project in 1959 and the Democratic Congress finally approved its construction on September 15, 1961 with a budget of \$114M. The contract and a separate land lease of the Sand Hill site for 50 years were signed in April 1962, and ground breaking started in July 1962.

Of all his accomplishments, building SLAC was probably Pief’s “finest hour”. The construction of the accelerator was completed in the summer of 1966 within schedule and within budget. Another of Pief’s visionary contributions to the success of SLAC was his realization that if physics research was going to start promptly upon completion of the accelerator, the instruments had to be developed in parallel with the machine. Strong groups of physicists were hired early on to design and build them. Many of these physicists, together with a strong particle theory group, made up the original SLAC Faculty. Hence, by

1967, the research program, which would become so successful and yield three Nobel Prizes in particle physics, was launched. Pief subsequently encouraged many other innovations and the laboratory flourished under his direction.

By 1976, the success of the SPEAR storage ring program, built at SLAC under Burt Richter's leadership, led to the proposal in 1980 of a much larger colliding beam machine called PEP which was the last new accelerator to come into successful operation under Pief's management. Pief stepped down as Director of SLAC in 1984 and became Emeritus Professor in 1989, but he continued to work at SLAC for the rest of his life.

### **Science Advising and International Science**

Starting as early as 1954, Pief's eclectic scientific expertise propelled him into national level science advising, first at the NSF, and later with the Air Force and with the President's Science Advisory Committee (PSAC), initially under George Kistiakowski during the Eisenhower Administration. As a result, in 1959, while he was taking a sabbatical at CERN, he got involved in his first negotiations with the Soviets. These negotiations eventually culminated in 1963 with the adoption of the Limited Test Ban Treaty with the USSR.

In addition to his service to various U.S. government panels, Pief also began to play a major role in international scientific organizations such as the International Union of Pure and Applied Physics (IUPAP). In the late 1970's, partially because of his efforts, government-to-government collaborative science agreements were signed by the U.S. with the Soviets, the Japanese and the People's Republic of China (PRC). Pief played major roles in all these collaborations, which have survived for over 25 years. The roster of senior scientists from many countries who, at the symposium held in Pief's memory at Stanford on April 10<sup>th</sup>, 2008, expressed their thanks for his help in the establishment of research enterprises, was an impressive acknowledgement of the role he had played all around the world.

### **Arms Control (1981-2007): the Unfinished Business**

The control and drastic reduction of nuclear weapons was a problem and a concern Pief confronted daily -- to the last day of his life. He involved himself in each and every controversy in this area, and while he sometimes seemed discouraged, he never gave up, always stuck to rational arguments in his speeches and writings, and never allowed himself to become a polemicist. He always retained the respect both of his friends and his adversaries.

As early as 1965 Pief was recruited to serve as a member of JASON, a group of academic scientists who advise the U.S. government on technical matters of general and national security interest. In 1981, he joined the Committee on International Security and Arms Control (CISAC) of the National Academy of Sciences, a committee he chaired from 1985 to 1993. CISAC started out by holding bilateral discussions with the Russians but these were later extended to very productive contacts with China, and then with allies such as France, Italy, Germany and the UK. In Italy these contacts developed into the multinational Amaldi conferences, which Pief attended regularly.

What positions did Pief take? He fundamentally believed that after 1945 and certainly during the Cold War, nuclear war was no longer a possible strategy for any nation, that nuclear weapons could not serve any military function except to deter another nation from attacking it with nuclear weapons. In summary, Pief supported the Limited Test Ban Treaty, the Threshold Test Ban Treaty, the Ban on Peaceful Nuclear

Explosions, the Nuclear Nonproliferation Treaty, the Anti-Ballistic Missile Treaty, and the Comprehensive Test Ban Treaty (which the U.S. Congress has yet to ratify). When President Reagan proposed his Star Wars project, Pief opposed it on technical grounds, arguing scientifically that the “offense would always outstrip the defense” because it would be less expensive and more effective. During his CISAC chairmanship, Pief argued eloquently against lumping nuclear, chemical and biological weapons under the single WMD label, and against threatening to use nuclear weapons to deter the use of the other two weapons. He also led the study for the management and disposition of excess plutonium, which came up with recommendations to fabricate mixed oxide fuel (MOX) combining plutonium and uranium oxides for use in reactors.

Many more details of Pief’s life and accomplishments can be found in his book, “Panofsky on Physics, Politics and Peace, Pief Remembers”, which he wrote in 2006-2007. Pief ends this book with a strong admonition to the world regarding the roughly 30,000 nuclear weapons still on our planet today. He viewed such a number to be far in excess of any nation’s security need. To him, the risks of their use due to faulty communications, regional conflicts, proliferation and theft, were unacceptable and could be totally devastating for humanity. He was concerned that as long as the U.S. relies on these weapons or continues to reinvent new missions for them, other countries will see them as symbols of national power and will wish to acquire them. Pief notes in his book that a declaration of “No First-Use” of nuclear weapons has so far been embraced only by China. He believed that, if adopted by all states that possess nuclear weapons, it would motivate drastic reductions, revitalize the entire nuclear weapons arms-control drive, and eventually lead to a worldwide prohibition. He writes, “The United States, as the unquestioned leader – measured by non-nuclear armaments and economic strength – should have the strongest possible interest in leading the reining-in of nuclear weapons on an irreversible basis.” The world could not honor this wonderful scientist and human being more than by heeding his advice on dealing with this ominous threat to humanity.

### **Honors, Awards and Society Memberships**

Panofsky received dozens of honors and awards during his career. Among them were the Ernest Orlando Lawrence Memorial Award (1961), the National Medal of Science (1969), the Decoration of “Officier de la Legion d’Honneur” of France (1977), the Enrico Fermi Award (1979), the Leo Szilard Award (1982), the Hilliard Roderick Prize (AAAS-1991), the Matteucci Medal (1997) and the International Scientific and Technological Award from the People’s Republic of China (2001).

Panofsky was a member of the National Academy of Sciences, the American Academy of Arts and Sciences, the Council on Foreign Relations, the American Physical Society (Fellow, and President in 1974), the American Philosophical Society, and he was elected foreign member of the Chinese Academy of Sciences, the Academie des Sciences (France), the Accademia Nazionale dei Lincei (Italy) and the Russian Academy of Sciences.

Pief is survived by Adele Panofsky, his wife of 66 years, of Los Altos, CA, his five children, Richard Panofsky of Rehoboth, Mass., Margaret Panofsky of N.Y., N.Y, Edward Panofsky of La Honda, CA, Carol Panofsky of Santa Cruz, CA, Steven Panofsky of Ukiah, CA, eleven grandchildren and three great-grandchildren.

Committee:  
Professor Gregory A. Loew  
Professor Sidney Drell  
Professor Helen Quinn