

= Kenneth Bainbridge =

Kenneth Tompkins Bainbridge (July 27 , 1904 ? July 14 , 1996) was an American physicist at Harvard University who did work on cyclotron research . His precise measurements of mass differences between nuclear isotopes allowed him to confirm Albert Einstein 's mass @-@ energy equivalence concept . He was the Director of the Manhattan Project 's Trinity nuclear test , which took place July 16 , 1945 . Bainbridge described the Trinity explosion as a " foul and awesome display " . He remarked to J. Robert Oppenheimer immediately after the test , " Now we are all sons of bitches . " This marked the beginning of his dedication to ending the testing of nuclear weapons and to efforts to maintain civilian control of future developments in that field .

= = Early life = =

Kenneth Tompkins Bainbridge was born in Cooperstown , New York , the second of three sons of William Warin Bainbridge and Mary Grinnell Tompkins . He was educated at Horace Mann School in New York . While at high school he developed an interest in ham radio which inspired him to enter Massachusetts Institute of Technology (MIT) in 1921 to study electrical engineering . In five years he earned both bachelor of science (S.B.) and master of science (S.M.) degrees . During the summer breaks he worked at General Electric 's laboratories in Lynn , Massachusetts and Schenectady , New York . While there he obtained three patents related to photoelectric tubes .

Normally this would have been a promising start to a career at General Electric , but it made Bainbridge aware of how interested he was in physics . Upon graduating from MIT in 1926 , he enrolled at Princeton University , where Karl T. Compton , a consultant to General Electric , was on the faculty . In 1929 , he was awarded a Ph.D. in his new field , writing his thesis on " A search for element 87 by analysis of positive rays " under the supervision of Henry DeWolf Smyth .

= = Early career = =

Bainbridge enjoyed a series of prestigious fellowships after graduation . He was awarded a National Research Council , and then a Bartol Research Foundation fellowship . At the time the Franklin Institute 's Bartol Research Foundation was located on the Swarthmore College campus in Pennsylvania , and was directed by W. F. G. Swann , an English physicist with an interest in nuclear physics . Bainbridge married Margaret (" Peg ") Pitkin , a member of the Swarthmore teaching faculty , in September 1931 . They had a son , Martin Keeler , and two daughters , Joan and Margaret Tomkins .

In 1932 , Bainbridge developed a mass spectrometer with a resolving power of 600 and a relative precision of one part in 10 @,@ 000 . He used this instrument to verify Albert Einstein 's mass @-@ energy equivalence , $E = mc^2$. Francis William Aston wrote that :

By establishing accurate comparisons of the masses of the light particles concerned in nuclear disintegrations , particularly that of ${}^7\text{Li}$, discovered by Cockcroft and Walton , he achieved a noteworthy triumph in the experimental proof of the fundamental theory of Einstein of the equivalence of mass and energy .

In 1933 , Bainbridge was awarded a prestigious Guggenheim Fellowship , which he used to travel to England and work at Ernest Rutherford 's Cavendish Laboratory at Cambridge University . While there he continued his work developing the mass spectrograph , and became friends with the British physicist John Cockcroft .

When his Guggenheim fellowship expired in September 1934 , he returned to the United States , where he accepted an associate professorship at Harvard University . He started by building a new mass spectrograph that he had designed with at the Cavendish Laboratory . Working with J. Curry Street , he commenced work on a cyclotron . They had a design for a 37 @-@ inch (940 mm) cyclotron provided by Ernest Lawrence , but decided to build a 42 @-@ inch (1 @,@ 100 mm) cyclotron instead .

Bainbridge was elected a Fellow of the American Academy of Arts and Sciences in 1937 . His

interest in mass spectroscopy led naturally to an interest in the relative abundance of isotopes . The discovery of nuclear fission in uranium @-@ 235 led to an interest in separating this isotope . He proposed using a Holweck pump to produce the vacuum necessary for this work , and enlisted George B. Kistiakowsky and E. Bright Wilson to help . There was little interest in their work because research was being carried out elsewhere . In 1943 , their cyclotron was requisitioned by Edwin McMillan for use by the U. S. Army . It was packed up and carted off to Los Alamos , New Mexico .

= = World War II = =

In September 1940 , with World War II raging in Europe , the British Tizard Mission brought a number of new technologies to the United States , including a cavity magnetron , a high @-@ powered device that generates microwaves using the interaction of a stream of electrons with a magnetic field . This device , which promised to revolutionize radar , demolished any thoughts the Americans had entertained about their technological leadership . Alfred Lee Loomis of the National Defense Research Committee established the Radiation Laboratory at the Massachusetts Institute of Technology to develop this radar technology . In October , Bainbridge became one of the first scientists to be recruited for the Radiation Laboratory by Ernest Lawrence . The scientists divided up the work between them ; Bainbridge drew pulse modulators . Working with the Navy , he helped develop high @-@ powered radars for warships .

In May 1943 , Bainbridge joined Robert Oppenheimer 's Project Y at Los Alamos . He initially led E @-@ 2 , the instrumentation group , which developed X @-@ ray instrumentation for examining explosions . In March 1944 , he became head of a new group , E @-@ 9 , which was charged with conducting the first nuclear test . In Oppenheimer 's sweeping reorganization of the Los Alamos laboratory in August 1944 , the E @-@ 9 Group became X @-@ 2 .

On July 16 , 1945 , Bainbridge and his colleagues conducted the Trinity nuclear test . " My personal nightmare , " he later wrote , " was knowing that if the bomb didn 't go off or hangfired , I , as head of the test , would have to go to the tower first and seek to find out what had gone wrong . " To his relief , the explosion of the first atomic bomb went off without such drama , in what he later described as " a foul and awesome display " . He turned to Oppenheimer and said , " Now we are all sons of bitches . "

Bainbridge was relieved that the Trinity test had been a success , relating in a 1975 Bulletin of the Atomic Scientists article , " I had a feeling of exhilaration that the ' gadget ' had gone off properly followed by one of deep relief . I wouldn 't have to go to the tower to see what had gone wrong . "

For his work on the Manhattan Project , Bainbridge received two letters of commendation from the project 's director , Major General Leslie R. Groves , Jr .. He also received a Presidential Certificate of Merit for his work at the MIT Radiation Laboratory .

= = Postwar = =

Bainbridge returned to Harvard after the war , and initiated the construction of a 96 @-@ inch synchro @-@ cyclotron , which has since been dismantled . From 1950 to 1954 , he chaired the physics department at Harvard . During those years , he drew the ire of Senator Joseph McCarthy for his aggressive defense of his colleagues in academia . As chairman , he was responsible for the renovation of the old Jefferson Physical Laboratory , and he established the Morris Loeb Lectures in Physics . He also devoted a good deal of his time to improving the laboratory facilities for graduate students .

Throughout the 1950s , Bainbridge remained an outspoken proponent of civilian control of nuclear power and the abandonment of nuclear testing . In 1950 he was one of twelve prominent scientists who petitioned President Harry S. Truman to declare that the United States would never be the first to use the hydrogen bomb . Bainbridge retired from Harvard in 1975 .

Bainbridge 's wife Margaret died suddenly in January 1967 from a blood clot in a broken wrist . He married Helen Brinkley King , an editor at William Morrow in New York City , in October 1969 . She died in February 1989 . A scholarship was established at Sarah Lawrence College in her memory .

He died at his home in Lexington , Massachusetts , on July 14 , 1996 . He was survived by his daughters from his first marriage , Joan Bainbridge Safford and Margaret Bainbridge Robinson . He was buried in the Abel 's Hill Cemetery on Martha 's Vineyard , in a plot with his first wife Margaret and his son Martin . His papers are in the Harvard University Archives .