ATOMS FOR PEACE AWARDS, INC.

A MEMORIAL TO
HENRY FORD AND EDSEL FORD

77 Massachusetts Avenue, Cambridge 39, Massachusetts
Office of the Executive Secretary: University 4-9870

FOR RELEASE AFTER DELIVERY
4:00 P.M., WEDNESDAY, MAY 18, 1960

Remarks by

EUGENE PAUL WIGNER

in response to

ATOMS FOR PEACE AWARD CITATION

The National Academy of Sciences

Washington, D.C.

Wednesday, May 18, 1960

3:00 p.m.

(WITH BIOGRAPHICAL NOTE)

Mr. President, Honored Trustees.

I feel deeply conscious of the great honor which was bestowed upon me and also sincerely grateful that it is Leo Szilard with whom I am sharing it. It was he who provided the original stimulus for my interest in nuclear energy and his foresight was a steady beacon in the early days of the work on nuclear reactors.

Leo: Thought you might like to see this
Bernie

ARC

January 31, 1957

Rola Personal

Atoms for Peace Awards, Inc.
Ford Foundation
477 Madison Avenue
New York, New York

Gentlemen:

I am writing to recommend Leo Szilard for your award this year.

It seems to me that the most significant discoveries leading to a chain reaction have been (a) the fission of uranium, (b) the emission of neutrons during that fission, and (c) a system that would slow down the neutrons without causing too many to be lost by absorption.

The first of these discoveries was med by Hahn and Meitner. The second was made independently and at about the same time by Szilard and Zinn (Physical Review, 1939), by Fermi and his coworkers, and by Joliot and his coworkers.

The crucial third discovery, that s system composed of uranium and graphite should be capable of amintaining a chain reaction, was to my knowledge first stated and discussed in detail in a theoretical paper sent by Szilard to the Physical Review in February, 1940. (This paper remained unpublished because of the necessary secrecy but the corresponding government report, A55 of the Uranium Committee, has since been declassified.) Furthermore, Szilard so clearly saw the importance and the practicability of this idea that he took steps, through Albert Einstien, to convince the U.S. Government of the urgency of supporting research to test the graphite-uranium system. The resulting success at Stagg Field, to which Fermi was the major contributor, needs no retelling.

It therefore seems to me that in the development of the chain reaction Szilard and Fermi stand out above all others. This conclusion is supported by the fact that a patent for the chain-reacting graphite-uranium system (U.S. No. 2,708,656) was issued to the Atomic Energy Commission in the name of Fermi and Szilard (see attached clipping from the New York Times). Fermi, of couse, is no longer alive. Incidentally, since the existence of this patent might raise the question of whether Szilard had not laready been richly rewarded for his contribution, it should be noted that his financial compensation for the invention which he assigned to the Government was limited to his actual expenses, amounting to less than $16,000.

After the war Szilard left the field of atomic energy and shifted to problems in biology, where he has made highly original contributions to microbial genetics. Since I am a biologist and not a physicist I am naturally better acquainted with this later work than with his contributions to atomic energy. It is therefore with some diffidence that I venture to make a nomination based on his work as a physicist. However, it seemed to me useful to do so since Szilard has been absent in recent years from the circles of physicists, and hence might conceivably be overlooked as a candidate.

In addition, I should like to point out that in biology as in physics Szilard has exhibited a restless curiosity. After making a decisive contribution on some fundamental problem, he has usually left its further development to others and has shifted his attention to new areas. In general, it seems to me that this kind of investigator is less likely to receive credit for scientific greatness than one who explores a chosen area in a more systematic and persistent fashion. However, I do not believe Szilard's contributions to the development of nuclear energy should be valued any less highly because of his subsequent departure from the field.

Finally, since the early work on a chain reactor was carried out with considerable emphasis on weapons development, your committee may well be considering the question of giving the award to a scientist whose contributions have been perhaps less revolutionary by also more specifically directed to peaceful uses. In this connection I should like to offer the personal opinion that the most important contribution to the peaceful uses of atomic energy has been the development of atomic energy itself.

Yours truly,

Bernard D. Davis
Chairman, Department of Pharmacology

cc: Mr. Bryce Leggett

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THE PRESENTATION

of the

ATOMS FOR PEACE AWARD

to

LEO SZILARD

EUGENE PAUL WIGNER

ALVIN MARTIN WEINBERG

WALTER HENRY ZINN

at the

NATIONAL ACADEMY OF SCIENCES

Washington, D. C.

MAY 18, 1960

THE CITATION

LEO SZILARD: By your wide-ranging interest in science and in the implications of scientific advance for human welfare, you have made significant contributions to man's search for knowledge and for peace.

Your studies of the nature of nuclear reactions led to an anticipation of the possibility of producing useful power by using the forces within the atom. With colleagues, some of whom we also honor today, you carried these studies to the attainment of the controlled nuclear chain reaction—the basis of the rapid development of atomic science in the past two decades

By your zeal and devotion to your work, you attracted promising young scientists to the new field and imbued them with your vision of its potentiality.

You have been untiring in your efforts to arouse men of all nations to the social and political implications of atomic energy.

May this medal, symbolizing the Atoms for Peace Award, signify to all men the importance of your contributions "for the benefit of mankind."

RESPONSE

LEO SZILARD

In 1913, one year before the first World War, H. G. Wells published a book entitled "The World Set Free" in which he predicts the discovery of artificial radioactivity and puts it into the year of 1933, the year in which it actually happened. In this book Wells describes how this discovery is followed by the release of atomic energy on an industrial scale, the development of the atomic bomb and a world war which is fought with such bombs. London, Paris, Chicago and many other cities are destroyed in this war, which Wells puts into the year of 1956. I read this book in 1932, before I myself had done any work in the field of nuclear physics.

In 1933, I went to live in London. In the fall of that year, the London papers reported a speech given by Lord Rutherford at a meeting of the British Association in which he said that whoever talked of the release of atomic energy on an industrial scale was talking moonshine. I was pondering about this while strolling through the streets of London. On that occasion, it occurred to me that Rutherford might be wrong, because there might exist an instable element that splits off neutrons when bombarded by neutrons and such an element could sustain a nuclear chain reaction. On the basis of the published masses of helium and beryllium, the beryllium nucleus should have been instable and it could have disintegrated into two alpha particles and one neutron, when hit by a neutron.

At this time, I was playing with the idea of shifting to biology. But the possibilities opened up by these thoughts were so intriguing that I moved into nuclear physics instead.

In the summer of 1934, T. A. Chalmers and I looked into the mystery of beryllium and found that beryllium emits neutrons when exposed to the gamma rays of radium. Other experiments showed, however, that gamma rays of lower energy were incapable of splitting beryllium and this made it appear doubtful that beryllium could sustain a nuclear chain reaction.

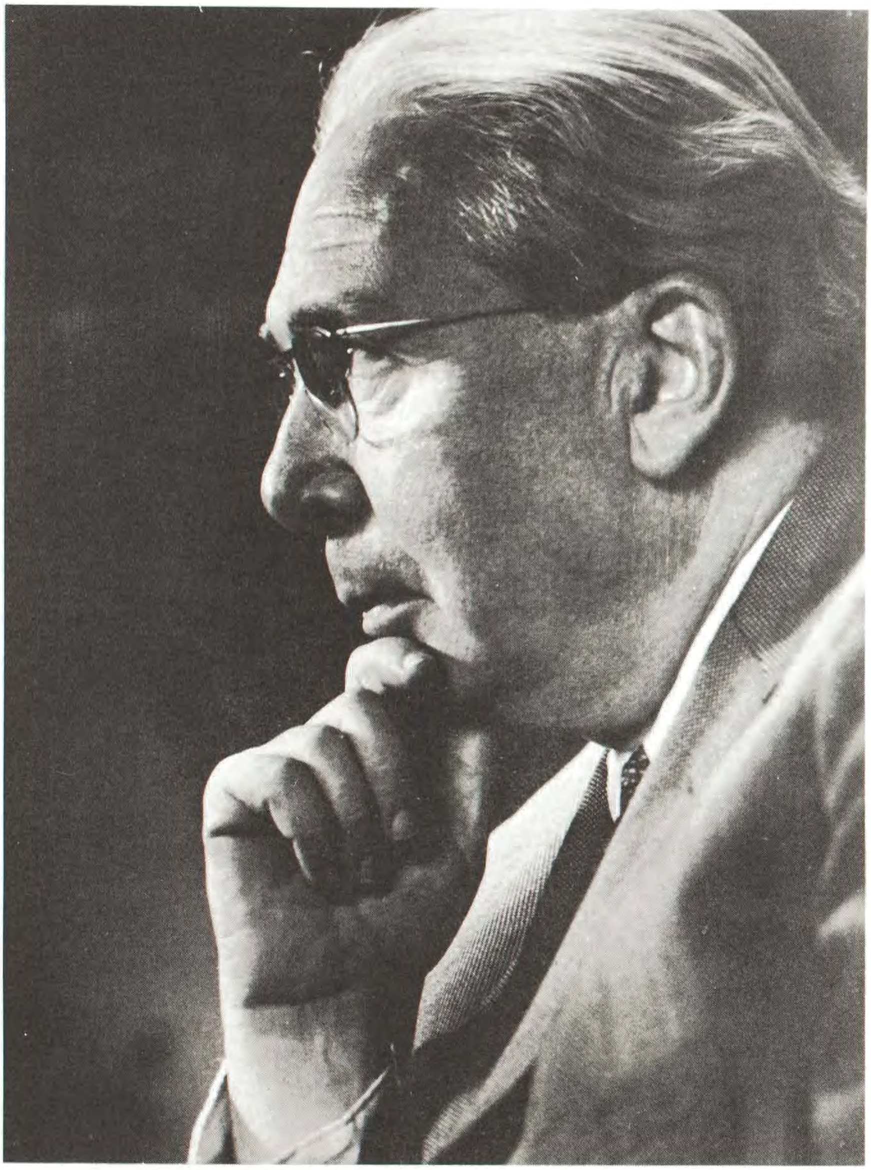
Nevertheless, the thought that some element or other might be capable of sustaining such a chain reaction stayed with me and I pursued it from time to time without success until I finally gave up hope in the fall of 1938. In December of 1938, I so advised the British Admiralty, to whom I had previously assigned a secret British patent which described the general laws governing nuclear chain reactions. One month later, I visited Wigner, who was ill with jaundice in Princeton. On that occasion I learned from him that Hahn and Strassman had found that the uranium nucleus breaks into two heavy fragments when it absorbs a neutron. To me, it appeared at once very likely that these fragments would evaporate neutrons and this meant that uranium might sustain a chain reaction. "H. G. Wells, here we come!" — I said to myself. Neither Wigner nor I had much doubt at that time that we were on the threshold of a World War. Finding out whether neutrons are emitted in the fission of uranium appeared to us, therefore, as a matter of great urgency.

The rest is history.

In 1945, as the war drew to its end, one of the younger staff members came into my office at the Uranium Project at the University of Chicago and said that he felt it was a mistake that so much emphasis was placed on the bomb and that we were not paying sufficient attention to the peacetime applications of atomic energy. "What particular peacetime applications do you have in mind?" I asked him, and he said, "The driving of battleships."

I often told this story after the war as a joke. These days, when we are rapidly moving towards the long range rocket stage of the so-called atomic stalemate, it seems to me that the story is even better, because it now represents two jokes rather than just one.

It is not always easy to say what is or is not a peacetime application of atomic energy, but if the large-scale liberation of atomic energy which we have achieved abolishes war, as it well may, the distinction will cease to be important. If war is to be abolished, the nations of the world must either enter into a formal agreement to get rid of the bomb or they must reach a meeting of the minds on how to live with the bomb. So far, we have not made much progress in either direction. It seems likely, however, that, as far as America is concerned, she will be forced to decide in favor of one or the other of these two alternatives during the term of office of the next President, and either decision might be better than no decision.



CITATIONS

RESPONSES

ATOMS FOR PEACE AWARDS

ATOMS FOR PEACE AWARDS

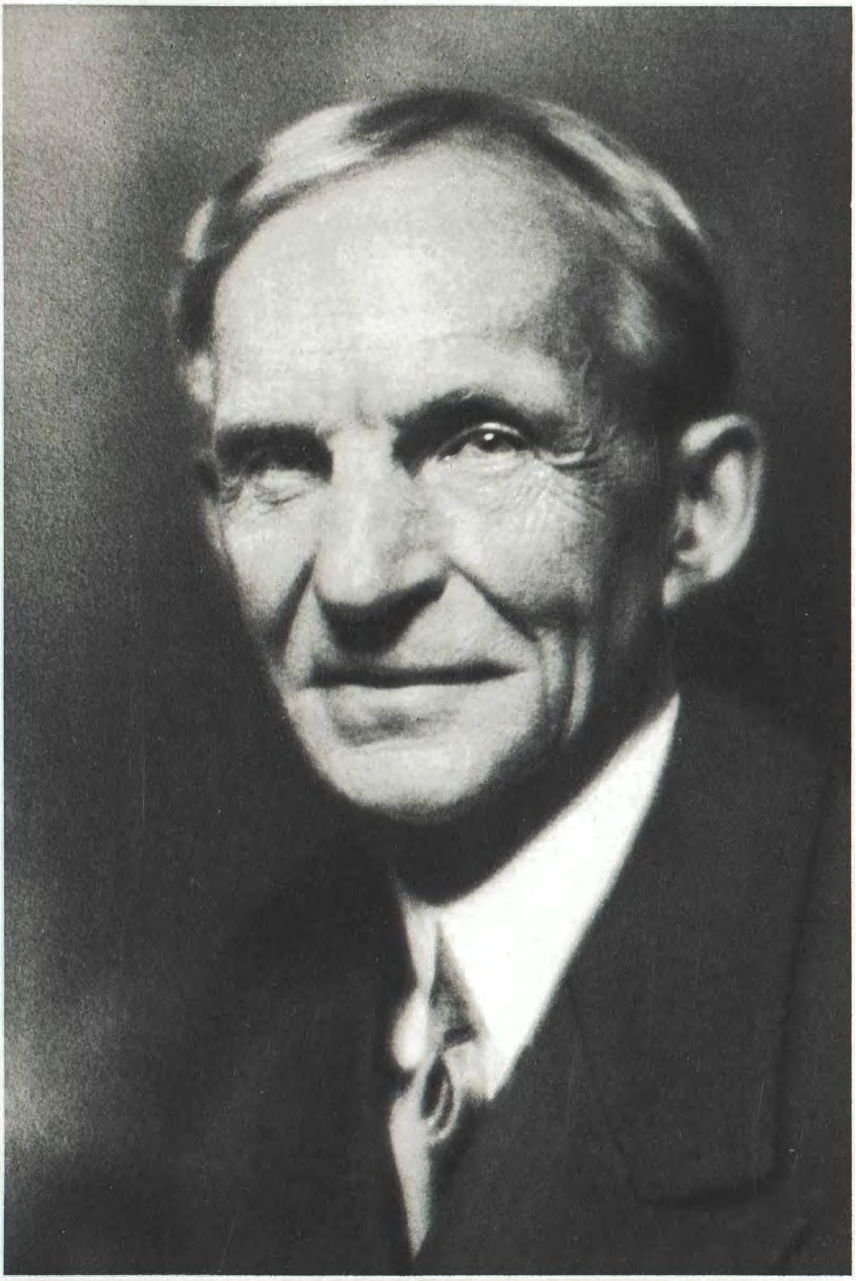
A MEMORIAL TO HENRY FORD AND EDSEL FORD

ATOMS FOR PEACE AWARDS, INC.

77 MASSACHUSETTS AVENUE

CAMBRIDGE 39, MASSACHUSETTS, U. S. A.

1956



HENRY FORD
1863-1947

FOREWORD

"The Italian navigator has landed in the new world."

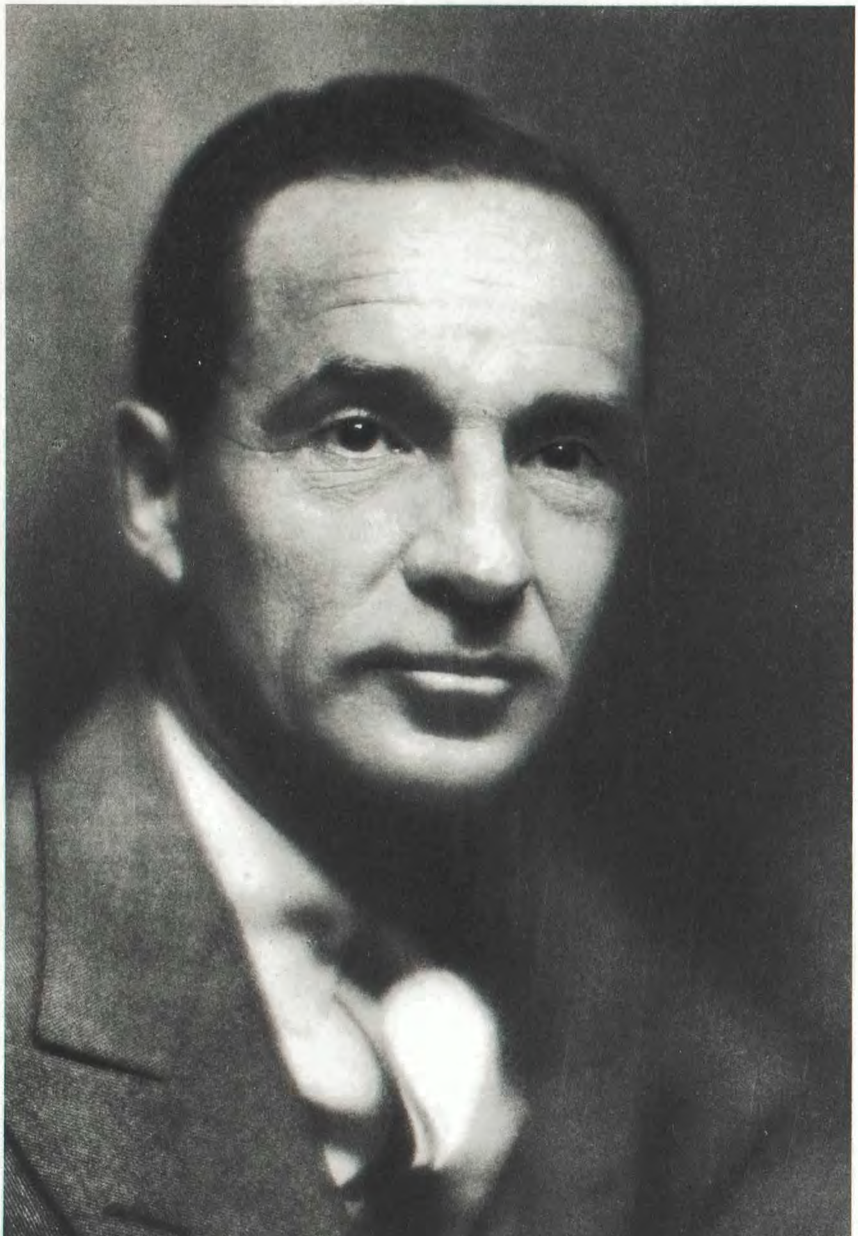
This coded telephone message from Arthur H. Compton in Chicago to James B. Conant in Cambridge, Massachusetts, announced the arrival of the Atomic Age. The date was December 2, 1942.

The "Italian navigator" was Enrico Fermi, leader of the small group of nuclear physicists working in an old squash court under the Stagg Field stands at the University of Chicago. The "new world" was that vast territory, for many years known by scientists to exist but until that historic day beyond the reach of any would-be explorer — the world of controlled nuclear fission.

Those few men who watched breathlessly as the world's first atomic pile became a self-sustaining energy producer knew that their success would bring basic changes to life in the world. They had unleashed the "power of the universe" — a power so awesome that until that final hour many of them had privately hoped that some basic principle might emerge to block the possibility of a nuclear explosive.

This was wartime; but from the first beginnings of the atom bomb project these men were also seeking means of harnessing their achievement for peace.

The use of atomic energy for peaceful purposes has since become a basic element in United States policy, as well as an international objective. Gradually, within the limits of



EDSEL FORD
1893-1943

security, America started releasing its atomic knowledge and products, for peaceful uses, to civilian scientists here and in other nations.

Throughout the world, these discoveries soon began to find a diversity of application — in medicine and biology, in agriculture, in the chemical processing of food and other products, and in the field of energy production. From these first steps, a strong hope began to grow — that in concentrating on peace men would turn away from war. The dissemination of knowledge and a freer exchange of atomic information among scientists everywhere might indeed, in President Eisenhower's words, "set the world more firmly on the path to peace."

On December 4, 1954, at the suggestion of President Eisenhower, the United Nations voted to establish an International Atomic Energy Agency to organize the world's nations in sharing atomic resources for peaceful ends. This action by the General Assembly was unanimous. In the same resolution, the United Nations voted to hold an international technical conference under its auspices to explore the promise of atomic energy and to develop methods for its peaceful use.

The first United Nations International Conference on the Peaceful Uses of Atomic Energy was held in Geneva, Switzerland, August 8-20, 1955, where 1,100 scientists from all over the world exchanged information.

It was at the Geneva Conference that Admiral Lewis L. Strauss, Chairman of the United States Atomic Energy Commission, announced the Atoms for Peace Awards. Established in memory of two great American industrialists of the twentieth century, these Awards stand as encouragement to men everywhere — "without regard for nationality, politics, or any other considerations except the merit of the contribution" — to work toward turning the energy of the atom to peaceful ends.

FOR THE BENEFIT OF MANKIND . . .

"I hope that private business and professional men throughout the world will take an interest and provide an incentive in finding new ways that this new science can be used . . . for the benefit of mankind and not destruction."

DWIGHT D. EISENHOWER
GENEVA, SWITZERLAND JULY 20, 1955

THIS DECLARATION prompted Henry Ford II, Benson Ford and William Clay Ford to take specific action toward the President's objective. The three grandsons of Henry Ford proposed to the Directors of the Ford Motor Company Fund that the Fund authorize an appropriation of $1,000,000 — $100,000 annually for 10 years — to be used for the advancement of the science of atomic energy for peaceful purposes by granting awards for outstanding contributions in this field and thus emphasizing its enormous importance to the people of the world.

The Directors of the Fund approved such an appropriation. They stipulated that a new institution be created as a non-profit corporation to receive and administer the funds, and that it be given the name of

ATOMS FOR PEACE AWARDS
A MEMORIAL TO HENRY FORD AND EDSEL FORD

The Directors of the Fund suggested that each year the Board of Trustees of Atoms for Peace Awards select from among the world's scientists and engineers — without regard for nationality or political belief — the individual or group of individuals who had made the greatest contribution to peaceful uses of atomic energy; that the individual or group so selected be granted, with appropriate ceremony, the Atoms for Peace Award for that year; that the annual award carry, in addition to a suitable medal to be designed and cast for the purpose, an honorarium of perhaps $75,000; that if during any year no candidate preeminently meriting the Atoms for Peace Award was found, the sum at the disposal of the memorial fund be used that year for purposes most likely to contribute to the advancement of the peaceful application of atomic energy.

The proposal to establish the Atoms for Peace Awards was announced at the World Conference on the Peaceful Uses of Atomic Energy in Geneva, Switzerland on August 8, 1955, by Admiral Lewis L. Strauss, Chairman of the United States Atomic Energy Commission.

Organization and Planning Committee

On August 12, 1955, four days after Admiral Strauss' announcement, James R. Killian, Jr., President of Massachusetts Institute of Technology, accepted the invitation of Henry Ford II to serve as chairman of an Organization and Planning Committee on the Atoms for Peace Awards.

Soon thereafter, six others accepted invitations to serve with Dr. Killian. They were:

Detlev W. Bronk, President of the Rockefeller Institute for Medical Research and President of the National Academy of Sciences;

Ralph J. Bunche, Under Secretary of the United Nations;

Arthur H. Compton, Professor, and former Chancellor, Washington University;

Mildred McAfee Horton, Former President of Wellesley College, and Wartime Director of the WAVES;

Mervin J. Kelly, President of Bell Telephone Laboratories; and

Alan T. Waterman, Director of the National Science Foundation.

The Committee appointed as legal counsel Harvey H. Bundy, of the firm of Choate, Hall and Stewart, Boston, Massachusetts. Philip A. Stoddard, of the Massachusetts Institute of Technology, was designated Interim Executive Assistant to the Committee.

In a series of meetings during October and November, 1955, the Committee considered questions of policy and administration for Atoms for Peace Awards. Their decisions and recommendations, which included a suggested Certificate of Incorporation and By-Laws for Atoms for Peace Awards, Inc., were submitted to the Ford Motor Company Fund. These were approved, and, on behalf of the Fund, Henry Ford II asked the members of the Committee to become members and Trustees of the proposed new non-profit corporation. With the approval of the Committee, Mr. Ford also asked that the new enterprise be housed at the Massachusetts Institute of Technology. These requests were granted.

Incorporation

The members of the Committee on Organization filed a Certificate of Incorporation with the Secretary of State of Delaware on the 17th of November, 1955, and met the following day to organize. The Certificate of Incorporation, implementing the original purpose of the Ford Motor Company Fund grant, contains the following provisions, among others:

> The name of the corporation is "Atoms for Peace Awards, Inc.", a non-profit corporation constituted as a memorial to Henry Ford and Edsel Ford and operated exclusively for "scientific, educational, or other charitable purposes."
>
> The recipient of the Atoms for Peace Award will be determined each year by the Trustees, who will select from among the world's scientists, engineers, or others, the individual, group of individuals or organization who in their judgment has made the greatest contribution to the peaceful uses of atomic energy. The decision of the Trustees will be made solely on the basis of the merit of the contribution, wherever found in the world.
>
> The Award is to consist of a cash honorarium accompanied by a suitable medal, to be designed and cast for the purpose. If the Board of Trustees should fail to discover a candidate preeminently meriting the Award in

any year, the Award and medal may be withheld during that year. In that event the Trustees may hold the funds available for additional awards in future years or dispose of that year's funds by grants in the United States of America to advance the science or technology relating to the uses of atomic energy for peaceful purposes.

The affairs and business of the corporation are to be managed and conducted by the Board of Trustees.

The seven members of the Organization and Planning Committee were elected Trustees. A President and Vice-President were elected from the Board of Trustees and a Secretary and Treasurer were elected from outside the Board, as follows:

President	James R. Killian, Jr.
Vice-President	Mildred McAfee Horton
Secretary	Harvey H. Bundy, former Assistant Secretary of State
Treasurer	Joseph J. Snyder, Treasurer of the Massachusetts Institute of Technology

By-Laws

The By-Laws, adopted on November 18, 1955, include these provisions:

The Board of Trustees, numbering at least seven but not more than eleven, are all to be citizens of the United

States, and are to have final and exclusive management of the funds and business of the corporation. The terms of the Trustees are staggered so as to establish a pattern of three-year terms.

No Award shall be made except by an affirmative vote of a majority of all Trustees.

The offices of President and Vice-President are to be filled annually by the Trustees from their own number; a Secretary and a Treasurer are to be elected annually, but not necessarily from among the Trustees. The Trustees may appoint other officers and agents for the management of the affairs of the corporation as they may from time to time deem wise.

Nominating Procedures

Under the direction of the Board of Trustees, the corporation will receive nominations for the Award from individuals and organizations, including learned societies, *in any part of the world.*

Appraisals will be based on information freely available in the public domain, and will not be concerned with information and data of a "classified" or "secret" kind.

It is contemplated that the Awards will go mainly to scientists or engineers, but an Award may be made to a person not included in these categories.

An Advisory Committee on Nominations, appointed by the Board of Trustees from citizens of the United States, will examine and evaluate the results of the preliminary screening and make recommendations for the Awards to the Trustees, who will make the final selection.

Advisory Committee on Nominations

The following were appointed to serve as members of the Advisory Committee on Nominations for the first year:

Robert F. Bacher, physicist, Director of the Norman Bridge Laboratory at the California Institute of Technology;

Robert F. Loeb, Professor of Medicine at Columbia University;

Robert A. Lovett, general partner, Brown Brothers Harriman & Co., former United States Undersecretary of State and Secretary of Defense;

I. I. Rabi, Professor of Physics at Columbia University and winner of the 1944 Nobel Prize in Physics; and

Charles A. Thomas, President, Monsanto Chemical Company.

Further Information

Correspondence and requests for information, especially with respect to the method for making nominations, may be directed to:

Executive Secretary
Atoms for Peace Awards, Inc.
77 Massachusetts Avenue
Cambridge 39, Massachusetts, U. S. A.

ATOMS FOR PEACE AWARDS, INC.

NOMINATIONS

The Trustees of Atoms for Peace Awards, Inc., are directed by the Charter of the corporation "to select from among the world's scientists, engineers, or others, an individual or group of individuals, or organization who or which is determined by the Trustees each year to have made the greatest contribution to the peaceful uses of atomic energy; provided that the merit of the contribution wherever found in the world shall alone be the basis for the decision by the Board of Trustees," and "to award to such individual, group of individuals, or organization an award to be known as 'The Atoms for Peace Award'."

TRUSTEES' CRITERIA

Any nominee will be considered for the Award whose work constitutes a significant contribution to the peaceful use of the atom for the good of mankind.

The Award will be made without regard for nationality, politics, or any other consideration except the merit of the contribution.

Information about the contribution must be freely available in the public domain.

It is not planned to grant the Award posthumously.

It is contemplated that the Awards will go mainly to scientists or engineers, but an Award may be made to a person not included in these categories.

TRUSTEES' CRITERIA

The Award will be made to an individual or, if warranted, to a small group of individuals who have contributed substantially equally to the advance for which the Award is made.

Contributions which may have military, as well as peaceful uses, are not to be excluded solely for this reason.

The Award is intended to be a recognition of current work. Current may be defined roughly as within the five years preceding the Award date, but it is recognized that contributions may take a longer period to have their merit demonstrated.

Qualified nominations received by Atoms for Peace Awards, Inc., will remain under consideration from year to year and need not be renewed. Additional pertinent information may be added to any nomination at any time. No weight shall be given to the number of nominators, taken by itself.

NOMINATING PROCEDURE

Any person or organization in the world is entitled to place in nomination the name of a person who has made a significant contribution to the peaceful use of the atom. The nominator is asked to submit the following information:

a. The name of the nominee.

b. His address and present occupation.

c. A full statement of the nature of the nominee's contribution to the use of the atom for the good of mankind.

d. References to the pertinent literature or, preferably (and especially in the case of less widely circulated journals), the actual pages of the journal or reprints of the articles.

e. An estimate of the value and relative importance of the contribution, in whatever form and at whatever length the nominator feels is desirable in support of the nomination.

Nominations should be sent to:

Executive Secretary
Atoms for Peace Awards, Inc.
77 Massachusetts Avenue
Cambridge 39, Massachusetts

Atoms for Peace Awards, Inc.

A MEMORIAL TO HENRY FORD AND EDSEL FORD

77 MASSACHUSETTS AVENUE, CAMBRIDGE 39, MASSACHUSETTS

September 5, 1957

Professor Leo Szilard
Professor of Physics
University of Chicago
Chicago, Illinois

My dear Professor Szilard:

The first Atoms for Peace Award will be presented to Professor Niels Bohr on October 24, 1957 in recognition, not only of his great contributions to nuclear science, but also of his leadership and vision in the search for the peaceful utilization of nuclear power.

The Trustees of Atoms for Peace Awards are directed to make the Award annually, if merited. They hope to do so and, therefore, again request your valued assistance. The general criteria to be used in selecting recipients for the Award are given in the enclosed leaflet. Your nominations will be greatly appreciated.

You may have already presented the names of persons whose contributions you judge to be worthy of recognition. These names will continue in nomination from year to year and need not be renewed. We shall be glad to have an additional evaluation of their work from you. You may, of course, submit other names as the evidence of significant contributions is developed.

The organization of Atoms for Peace Awards, Inc. is continued for another year as is shown in the enclosed brochure, except that Dr. Robert E. Marshak has joined the Advisory Committee on Nominations to replace Dr. Isidor I. Rabi.

Very truly yours,

J. R. Killian, Jr.

J. R. Killian, Jr.
President

ATOMS FOR PEACE AWARDS, INC.

CERTIFICATE OF INCORPORATION

FIRST The name of the corporation is ATOMS FOR PEACE AWARDS, INC.

SECOND Its principal office in the State of Delaware is located at 100 West 10th Street in the City of Wilmington, County of New Castle. The name and address of its resident agent is The Corporation Trust Company, 100 West 10th Street, Wilmington, Delaware.

THIRD The corporation shall constitute a memorial to Henry Ford and Edsel Ford, and the nature of its business or objects or purposes to be transacted, promoted or carried on are:

To be organized and operated exclusively for the scientific, educational, or other charitable purposes hereinafter specified, provided that no part of the net earnings or of any other funds of the corporation shall enure to the benefit of any member or individual having a personal or private interest in the activities of the corporation, that no part of the corporation's activities shall be carrying on propaganda, or otherwise attempting, to influence legislation, and that the corporation shall not in any way participate in, or intervene in, any political campaign on behalf of any candidate for public office;

To select from among the world's scientists, engineers, or others, an individual or group of individuals, or organization who or which is determined by the Trustees each year to have made the greatest contribution to the peaceful uses of atomic energy; provided that the merit of the contribution wherever found in the world shall alone be the basis for the decision by the Board of Trustees;

To award to such individual, group of individuals, or organization an award to be known as "The Atoms for Peace Award" in such sum as the Trustees may determine, in addition to a suitable medal to be designed and cast for the purpose, such award and medal to be conferred in the United States of America; provided that the recipient of such award shall be selected without action on his part to enter any contest or proceeding for such award and shall not be required to perform any future services as a condition to receiving such award, and provided that if during any year the Board of Trustees shall in their discretion find no candidate preeminently meriting the Atoms for Peace Award, the award and medal may be withheld during that year, and the Trustees may hold available funds for future additional award or awards in any year or years, or may dispose of such funds of the corporation by grant or otherwise in the United States of America in the manner deemed by them most likely to accomplish the foregoing scientific, educational, or charitable purposes by contributing to the advancement of the science or technology relating to the uses of atomic energy for peaceful purposes;

To take and hold by bequest, devise, gift, purchase, or lease, either absolutely or in trust for any of its purposes, any property, real or personal, without limitation as to amount or value; to convey such property and to invest and reinvest any such property and any income therefrom and deal with and expend its property, including income and principal, in such manner as in the judgment of the Trustees will best promote its objects;

To publish and circulate reports, pamphlets, or other printed matter dealing with the purposes and activities of the corporation;

To have one or more offices within or without the State of Delaware;

To do all such acts as shall be necessary or proper in connection with or incidental to any of the aforesaid purposes.

FOURTH This corporation shall be a membership corporation and shall have no authority to issue capital stock. The corporation is not organized and shall not be conducted for profit.

The membership of the corporation shall consist of the Trustees, who shall be elected by the incorporators named in this Certificate of Incorporation, together with such additional members, whether as successors to the original members or as additional members, as shall be elected to membership upon the terms and conditions which shall be set forth in the By-Laws of the corporation. Continuance of membership shall be governed by the provisions of the By-Laws. Each member shall be entitled to one vote in person or by proxy at all meetings of the members.

Any member may withdraw from the corporation by a notice in writing to the President or Secretary.

FIFTH The affairs and business of the corporation shall be managed and conducted by a Board of Trustees, who shall be elected to office in such manner, and for such term, and who shall have such powers and duties, as may be provided in the Certificate of Incorporation or in the By-Laws.

Vacancies on the Board of Trustees caused by death, resignation, removal or disqualification shall be filled in such manner as may be provided in the By-Laws.

SIXTH The names and places of residence of the incorporators are as follows:

NAMES	RESIDENCE
DETLEV W. BRONK	*Media, Pennsylvania*
RALPH J. BUNCHE	*Kew Gardens, New York*
ARTHUR H. COMPTON	*St. Louis, Missouri*
MILDRED McA. HORTON	*Cambridge, Massachusetts*
MERVIN J. KELLY	*Short Hills, New Jersey*
JAMES R. KILLIAN, JR.	*Cambridge, Massachusetts*
ALAN T. WATERMAN	*Washington, D. C.*

SEVENTH The corporation is to have perpetual existence.

EIGHTH The private property of the members shall not be subject to the payment of the corporate debts to any extent whatever.

NINTH In furtherance, and not in limitation of the powers conferred by statute, the following are provisions for the regulation of the business conduct of the affairs of the corporation, and creating, defining, limiting and regulating the powers of the corporation, the Trustees and the members:

The number of Trustees shall be such number as the incorporators may determine upon at their first meeting and thereafter as determined by the members in accordance with the By-Laws, provided that such number shall be at least seven (7) and not more than eleven (11).

The terms of office of the Trustees shall be determined in accordance with the By-Laws, and the powers of the Trustees shall be determined in accordance with the By-Laws.

In case of the dissolution of the corporation no dividends or other distribution of any of the property or assets of the corporation shall be made to any member, trustee or officer thereof, but all of such property and assets shall in such case be applied to accomplish the general purposes for which the corporation is organized as the proper court having jurisdiction may direct.

TENTH Meetings of the members may be held without the State of Delaware, if the By-Laws so provide. The books of the corporation may be kept (subject to any provision contained in the statutes) outside the State of Delaware at such place or places as may be from time to time designated by the Board of Trustees.

ELEVENTH The corporation reserves the right to amend, alter or repeal any provision contained in this Certificate of Incorporation in the manner now or hereafter provided by statute, and all rights conferred on members herein are granted subject to this reservation, except that no such amendment shall be made which would change the nature of its business or objects or purposes to be transacted, promoted or carried on to include any business, object or purpose which would not be exclusively scientific, educational, or otherwise charitable, or which would permit any part of the net earnings or of any other funds of the corporation to enure to the benefit of any member or individual having a personal or private interest in the activities of the corporation, or would permit the corporation to carry on propaganda, or otherwise influence legislation, or to participate in, or intervene in, any political campaign on behalf of any candidate for public office.

WE, THE UNDERSIGNED, being each of the incorporators hereinbefore named for the purpose of forming a corporation in pursuance of the General Corporation Law of the State of Delaware do make this Certificate, hereby declaring and certifying that the facts herein stated are true, and accordingly have hereto set our hands and seals this fourth day of November, A.D. 1955.

DETLEV W. BRONK	MERVIN J. KELLY
RALPH J. BUNCHE	JAMES R. KILLIAN, JR.
ARTHUR H. COMPTON	ALAN T. WATERMAN
MILDRED McA. HORTON	

ATOMS FOR PEACE AWARDS, INC.

BY-LAWS

ARTICLE I — NAME, SEAL AND OFFICES

The name of this corporation is Atoms for Peace Awards, Inc. The seal of the corporation shall be a circular form bearing the words and figures "Atoms for Peace Awards, Inc., Delaware, Incorporated 1955." In addition to the principal office in the State of Delaware, the corporation shall have a principal office for the conduct of its business in Cambridge, Massachusetts, and offices at such other places within or without the State of Delaware as may be determined by the Trustees.

ARTICLE II — MEMBERS AND TRUSTEES

The incorporators of the corporation shall as hereinafter provided elect a board of not less than seven nor more than eleven Trustees who shall be citizens of the United States of America. Upon such election such Trustees and their successors and any additional Trustee or Trustees elected as hereinafter provided shall constitute the members of the corporation. No person shall continue to be a member of the corporation unless such person is also a Trustee, and no person shall continue to be Trustee after ceasing to be a member. Membership in or any other interest in this corporation shall not be assignable inter vivos by any member nor shall membership in or any interest in this corporation pass to any personal representative, heir or devisee.

The Board of Trustees shall be known as the Trustees of Atoms for Peace Awards, Inc., and shall exercise all powers of directors and such other powers as are given by law, by the Certificate of Incorporation of the corporation and by these By-Laws. They shall have the final and exclusive management of the funds and business of the corporation.

ARTICLE III — MEMBERSHIP IN BOARD OF TRUSTEES

The Board of Trustees shall be at least seven and shall not exceed eleven in number, all of whom shall be citizens of the United States of America and their terms of office as Trustees shall be as follows — at the first election by the incorporators three Trustees shall be elected to serve until the next annual meeting, three Trustees to serve until the second annual meeting, and the remaining Trustee or Trustees, not to exceed five, to serve until the third annual meeting following their election. Thereafter Trustees shall be elected by the members to serve until the third annual meeting following their election. No person shall be elected a Trustee after such person has passed his or her seventy-second birthday.

The members shall have power at any special meeting to elect at any time between annual meetings additional Trustees who are citizens of the United States of America, but the entire number of Trustees shall at no time exceed eleven. The term of office of all Trustees shall continue until their successors are duly elected and qualified.

The Board of Trustees shall have power to fill vacancies and it shall be the duty of the Board of Trustees to fill vacancies whenever the Board of Trustees by reason of death, resignation or removal shall fall below seven. Any Trustee elected to fill a vacancy shall serve for the same term as the Trustee whose place he is elected to fill.

The Trustees shall be entitled to be reimbursed for all expenses properly incurred by them in the performance of their duties and shall receive such compensation for attendance at meetings or special services as the Trustees may determine.

ARTICLE IV — MEETINGS

SECTION 1: *Annual Meetings of Members* The annual meeting of the members of the corporation for the election of Trustees and for the transaction of such other business as may properly come before such meeting shall be held at 77 Massachusetts Avenue, Cambridge, Massachusetts, on the first Wednesday in March of each year.

SECTION 2: *Special Meetings of Members* Special meetings of the members of the corporation shall be called and held within or without the State of Delaware as directed by the Board of Trustees or upon the written request of a majority of the members of the corporation.

SECTION 3: *Notice of Meetings of Members* Notice of each meeting of members, whether annual or special, shall be given by mailing to each member postage prepaid at least fourteen days prior to the date of such meeting a notice thereof at his address as it appears on the records of the corporation. Notice of any meeting of members may be waived by any member in writing or by telegraph or cable confirmed in writing either prior to or subsequent to the holding of such meeting. Each notice of a meeting shall state the time and place appointed for the holding thereof and generally the business to be transacted thereat.

SECTION 4: *Voting and Quorum* Each member shall be entitled to one vote in person or by proxy and a majority of the members of the corporation present in person or by proxy shall constitute a quorum. If there be no quorum at a meeting or at any adjournment thereof, the members present may adjourn such meeting or adjourned meeting without notice other than by announcement at the meeting until a quorum is present and thereupon any business may be transacted which might have been transacted at the meeting as originally called had the same been held.

SECTION 5: *Meetings of Trustees* The Trustees may by standing order constitute regular meetings of the Board at such time and place within or without the State of Delaware as they may determine, of which no special notice from the Secretary shall be required. Special meetings within or without the State of Delaware shall be called at the request of four or more Trustees or at the direction of the President. The Secretary shall send to each Trustee by mail a written notice of each special meeting of the Board of Trustees at least seven days before such meeting at the address of such Trustee as it appears upon the records of the corporation. Notices of special meetings shall specify generally the business to be transacted thereat. Four Trustees shall constitute a quorum for the transaction of business. Notice of any meeting of Trustees may be waived by any Trustee in writing or by telegraph or cable confirmed in writing either prior to or subsequent to the holding of such meeting.

SECTION 6: Except as provided by the laws of Delaware or otherwise provided in these By-Laws, a majority of the members present in person or by proxy at any duly constituted meeting of members, and in the case of Trustees a majority of the Trustees present at a duly constituted meeting of the Trustees, may decide any question and take any action which may properly come before such meeting. However, the determination of any award in accordance with the provisions of the Certificate of Incorporation shall not be made except by the affirmative vote of a majority of the Trustees then in office.

ARTICLE V — OFFICERS AND COMMITTEES

SECTION 1: *President, Vice-President, Other Officers, Committees* The Trustees shall elect from their own number a President and a Vice-President who shall serve for one year and until their respective successors are elected and qualified. They may elect and constitute from their own number such other officers and committees as from time to time they shall deem expedient, and may delegate to such officers and committees such powers as to them may seem wise, except that all expenditures of money shall be authorized or approved by the Board of Trustees. Any such officer or other committee may be removed at any time by majority vote at a meeting of the Board of Trustees.

SECTION 2: *Secretary, Treasurer, Appointed Officers* The Trustees shall annually elect persons, who need not be from their own number, as Secretary and as Treasurer and, when needful in the opinion of the Trustees, an Assistant Treasurer and may appoint such other officers and agents for the management of the affairs of the corporation as they may from time to time deem wise, and such officers shall hold office at the pleasure of the Trustees and may be removed at any time by majority vote at a meeting of the Board of Trustees. The Trustees shall at least annually cause the books and accounts to be audited by a certified or professional accountant.

SECTION 3: *Advisory Committee on Nominations* The Board of Trustees may appoint a committee, not necessarily in whole or in part of their number, of such size and for such terms as they may determine, as *The Advisory Committee on Nominations* for the purpose of examining and evaluating the merit of contributions which they may consider appropriate for the awards, and giving advice to the Trustees in respect thereto. The members of this Committee shall all be citizens of the United States of America. The information with respect to the merit of contributions shall be submitted to the Committee in the United States of America, and the recommendations of such Committee shall be made to the Trustees in the United States of America who shall have final authority to determine all matters of awards. Members of such Committee shall receive such compensation for their services as the Board of Trustees may determine.

SECTION 4: *Vacancies* Any vacancy in any office or in the membership of any committee may be filled at any time by the Board of Trustees.

ARTICLE VI — DUTIES OF OFFICERS

SECTION 1: *President* The President shall be the chief executive officer of the corporation and shall preside at all meetings of the members and of the Board of Trustees. He shall perform such other duties as may be directed from time to time by the Board of Trustees.

SECTION 2: *Vice-President* The Vice-President shall preside at all meetings of the members and of the Board of Trustees in the absence of the President and shall perform such other duties as may be directed from time to time by the Trustees.

SECTION 3: *Secretary* The Secretary shall give all notices of meetings of members or of the Board of Trustees as to which notice is required and shall record all action taken at any meeting of members or of the Board of Trustees in a book or books to be kept for that purpose. The Secretary shall have custody of the seal and of the records of the corporation and shall perform such other duties as the Board of Trustees may from time to time prescribe. He shall affix and attest the corporate seal to any instrument whose execution under seal shall have been duly authorized.

SECTION 4: *Treasurer* The Treasurer shall have custody of the funds and other property of the corporation and shall keep accurate record thereof and of all receipts and disbursements of the corporation in financial books to be kept for that purpose and shall deposit all monies and other valuable effects in the name and to the credit of the corporation in such depository as shall be designated by the Board of Trustees. He shall be charged with the disbursement of funds of the corporation and the taking of proper vouchers therefor and shall render to the Board of Trustees such reports as such Board shall prescribe. He shall, if required by such Board, furnish bond, as prescribed by such Board, for the faithful performance of his duties. All books and vouchers shall be open to the inspection of any member of such Board. He shall at least once a year, and whenever requested by vote of such Board, render a full and detailed account of all receipts and expenditures and submit a schedule showing all property and investments of the corporation and the changes, if any, since his last report. He shall perform such other duties as may from time to time be delegated to him by such Board or any duly authorized committee thereof.

ARTICLE VII — AMENDMENT OF BY-LAWS

These By-Laws may be amended at any regular meeting or at any special meeting of members duly called and held for the purpose, provided that the substance of the proposed amendment shall be stated in the notice of the meeting.

Portraits of Henry Ford and Edsel Ford by Pirie MacDonald

Presentation of the

ATOMS FOR PEACE AWARD

to

Leo Szilard and Eugene P. Wigner
Walter H. Zinn and Alvin M. Weinberg

WEDNESDAY, MAY 18, 1960, 3:00 P. M.

NATIONAL ACADEMY OF SCIENCES

2101 Constitution Avenue, Washington, D. C.

ATOMS FOR PEACE AWARDS, INC.

77 Massachusetts Avenue, Cambridge 39, Mass. *Telephone — Cambridge: University 4-9870*

Washington: Executive 3-8100 — ext. 310

ATOMS FOR PEACE AWARDS

The Atoms for Peace Awards grew out of a statement made by President Eisenhower in Geneva on July 20, 1955 when he called for renewed international effort in the harnessing of nuclear science to peaceful uses and concluded with the hope that "private business and professional men throughout the world will take an interest and provide an incentive in finding new ways that this new science can be used . . . for the benefit of mankind and not destruction."

It was in response to this appeal that the Ford Motor Company Fund created the Atoms for Peace Awards as a memorial to Henry Ford and Edsel Ford. The Fund authorized an appropriation of $1,000,000 — to be used at the rate of $100,000 annually for 10 years — for awards for outstanding contributions in this field.

Atoms for Peace Awards are granted by a wholly independent non-profit scientific and educational corporation established for that purpose in November, 1955. The corporation is housed at The Massachusetts Institute of Technology and is managed by a Board of Trustees headed by James R. Killian, Jr., Chairman of the Corporation of the Institute.

The recipient of the Award in any year is determined by the Trustees from among the world's scientists, engineers, or others, who in their judgment has made the greatest contribution to the peaceful uses of atomic energy. This may be an individual, a group of individuals, or even an organization. The Award is made without regard for nationality, politics, or any other consideration except the merit of the contribution. Anyone in the world is entitled to place in nomination the name of a person he believes to have made a significant contribution.

The 1959 and 1960 Awards are the third and fourth in the series. A total grant of $150,000 will be shared by the recipients and each will receive a gold medallion symbolizing the Award.

Presentation of the

ATOMS FOR PEACE AWARD

to

LEO SZILARD

EUGENE PAUL WIGNER

ALVIN MARTIN WEINBERG

WALTER HENRY ZINN

PRESIDING JAMES RHYNE KILLIAN, JR.

SPEAKERS ISIDOR ISAAC RABI

MANSON BENEDICT

GREAT HALL, NATIONAL ACADEMY OF SCIENCES

WASHINGTON, D. C.

MAY 18, 1960 3:00 P.M.

THE PRESENTATION

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Washington, D. C.

MAY 18, 1960

INTRODUCTION

The Atoms for Peace Awards are a response to world-wide interest in the potential made available to mankind by the unlocking of the nucleus of the atom. They had their origin in the vision of President Dwight D. Eisenhower who called upon "business and professional men throughout the world to take an interest and provide an incentive in finding new ways that this science can be used . . . for the benefit of mankind and not destruction." They are a tribute to the memory of Henry Ford and Edsel Ford.

The recipient of the 1957 Atoms for Peace Award was Professor Niels Bohr of Denmark; the 1958 award went to Professor George Charles de Hevesy of Sweden.

This volume reports the Award ceremony held, through the courtesy of the President and Council of the Academy, at the National Academy of Sciences in Washington, D. C. It was a great privilege to present the Awards in that setting, a focal point of American science and an important link in the world-wide interrelationships among scientists and their societies.

James R. Killian, Jr.
Chairman
Trustees of Atoms for Peace Awards

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Introduction of
MANSON BENEDICT

by

JAMES R. KILLIAN, JR.

In the present Awards, the Trustees, guided by helpful information and evaluations from thoughtful people in many countries throughout the world, wish to recognize the revolutionary importance of the nuclear reactor as a research tool in many areas of science and technology, as a source of the radio-isotopes which are so useful in research, medical therapy, and industry, and as a source of power.

The Trustees were assisted in the selection of the recipients by a distinguished panel of advisors: Dr. James B. Fisk, Dr. Lawrence R. Hafstad, Dr. Samuel K. Allison, and Dr. Manson Benedict. The reasons for their advice, based as it was upon their own experience and the freely-given opinions of other knowledgeable people, and for the Trustees' decisions, were numerous and significant. We have asked Professor Manson Benedict, who has been associated as a scientist, engineer, and teacher with the development of nuclear technology from the early days, to tell of the role of the Award recipients in reactor development. It is a pleasure to introduce to you Professor Manson Benedict, a member of this Academy and Head of the Department of Nuclear Engineering at the Massachusetts Institute of Technology.

THE ROLE OF THE AWARD WINNERS IN REACTOR DEVELOPMENT

MANSON BENEDICT

Today we honor the four men who, of all men living, have done most to originate and perfect the nuclear fission chain reactor, Leo Szilard, Eugene Wigner, Walter Zinn and Alvin Weinberg. It is appropriate that the fission chain reactor be the central theme of the occasion, because it alone, of all devices thus far conceived, provides a practical means for utilizing the energy of the atomic nucleus and producing radio-isotopes in abundance. These gifts of the atom, if used wisely, will be of inestimable benefit to mankind.

In these days when nuclear reactors have become commonplace it is easy to overlook the absolutely revolutionary character of these devices. Let us not forget that in the nuclear fission chain reactor mass is converted into energy in a controlled manner, and the alchemists' dream of transmuting one element into another is at last realized. A generation ago no one conceived that the practical means for carrying out these processes would be devised so soon through the inspired work of these four men and their scientific and engineering colleagues.

Leo Szilard seems to have been marked by destiny to develop the nuclear reactor. After leaving his native

Hungary he served as Einstein's assistant in Germany. We may imagine that he here acquired a keen appreciation of the enormous amount of energy locked up in the mass of the atomic nucleus. At a more practical level, we may note that Szilard and Einstein invented an electromagnetic pump for liquid metals, which many years later proved useful in nuclear reactors. Subsequently, Szilard went to England, where he investigated many schemes for utilizing the energy of the nucleus, but found none then that were workable. Szilard paid special attention to the production of neutrons in nuclear reactions, for he realized that if a neutron-induced reaction could be found in which more neutrons were produced than were consumed, the key to unlocking the energy of the nucleus might be at hand. He came to Columbia University, and there in 1938 he learned of Hahn and Strassman's discovery that neutrons caused uranium to undergo fission. It was realized at once that fission would release tremendous amounts of energy, and there was good reason to believe that neutrons might also be produced. Here might be the long-awaited chain reaction from which the energy of the nucleus could be tapped.

Szilard enlisted as a collaborator the young Canadian physicist, Walter Zinn, then on the faculty at the City College of New York. The two men devised an experiment to measure the number of neutrons produced when a uranium atom undergoes fission with slow neutrons. The rough result, of two fast neutrons produced per fission, seemed promising, but the question remained whether it provided sufficient margin to allow for non-fission absorption of neutrons by uranium and other materials while fast neutrons were being slowed down to the point where they could continue the fission chain reaction.

Szilard quickly recognized that graphite was one of the best materials to slow down neutrons because it absorbed so few neutrons, and that the neutrons would have a better chance of escaping capture by uranium if the uranium were in lumps spaced evenly throughout the graphite rather than mixed intimately with it. He foresaw the importance of using the purest possible graphite and uranium. He discussed these points with Enrico Fermi, who was also experimenting with uranium at Columbia. These men devised the now-classic experiment to measure the multiplication factor of such a graphite-uranium lattice. If conditions could be found under which the multiplication factor could be made greater than unity, a chain reaction with these materials would be possible; if less than unity, the process would not work.

At the same time Eugene Wigner, Professor of Theoretical Physics at Princeton University, was also deep in calculations of the conditions under which a neutron chain reaction in uranium might be made to take place. Wigner was a fellow countryman of Szilard's and an authority on the symmetry properties of molecules, atoms, and nuclei and the resonance absorption of neutrons. Szilard, Fermi and Wigner exchanged ideas freely and in a series of weekly conferences at Princeton planned and interpreted the historic experiments on graphite and uranium being conducted at Columbia.

The reports of this period give us some appreciation of the primitive conditions under which this early work was carried out and the excitement which the experimental results inspired. In Pupin Physics Laboratory of Columbia University, Fermi and Zinn pressed hundreds of pounds of uranium oxide powder into lumps and sawed tons of graphite into bars. Stacking the piles of these materials was hard, dirty work, an incongruous activity for a university in the heart of New York City. Yet the experimenters had their reward as they learned how to increase the multiplication factor from experiment to experiment, until by late 1941 it seemed that a value above unity might be attainable. With a sufficient quantity of highly purified uranium and graphite, a nuclear chain reaction should be possible.

Meanwhile, the indefatigable Szilard, from the purposeful clutter of his small room at the King's Crown Hotel, wrote letters and reports and did everything possible to ensure the success of the experiments. He developed the theory of uranium-graphite lattices and suggested new experiments. He inquired into supplies of uranium and sought purer materials. Szilard's pioneering efforts in these early days were recognized many years later by the award to him and Fermi of the basic U. S. patent on nuclear reactors.

During this period Szilard was just as active in the political sphere as in the technical. He sought and obtained the support of the U. S. government for the uranium project by characteristic direct action. With Wigner he acquainted Einstein with the possibilities of the project and provided Einstein with the information the latter used in his now famous letter to President Roosevelt.

In early 1942, wartime necessity dictated that work on the uranium project be centralized at the University of Chicago under the direction of Arthur Compton, and its pace greatly accelerated. At this time Fermi, Szilard, and Zinn moved to Chicago, where, in less than a year, they completed successfully one of the world's most celebrated experiments. With Fermi in charge of the work, Zinn built the world's first nuclear reactor, using pure graphite and uranium provided through Szilard's foresight. In a squash court under the West Stands of Stagg Field in the heart of Chicago, on December 2, 1942, this pile of graphite and uranium went critical and ushered in the atomic era. To Compton's famous coded telephone message to Conant, "The Italian navigator has just landed in the new world," we should add that the vessel used by the Italian navigator was built by a Canadian shipwright from rare and costly materials found by a Hungarian explorer.

In the summer of 1942, Wigner also came to Chicago, to take charge of the theoretical division of the laboratory. When the decision was made to build the Hanford reactors, which were to be the world's first transmutation factories, Wigner was placed in charge of their design. As experimental results were obtained by Fermi and Zinn, the group headed by Wigner incorporated them into the design of the Hanford reactors. Wigner is responsible for the wise choice of water cooling for these reactors, an engineering decision that did much to ensure their success. Szilard, with his usual foresight, saw the need for intensive efforts on the fabrication of uranium metal and the development of aluminum cladding and helped assemble the group of metallurgists who perfected these operations.

An important member of Wigner's theoretical group was a young Chicago physicist, Alvin Weinberg, whose function in these busy days was to be the "Czar of k," the keeper of criticality calculations. Would the introduction of aluminum for cladding and water for cooling absorb so many precious neutrons that the pile would not go critical? Would the fractional parts per million of boron left in the ultra pure uranium and graphite poison the reactors? Weinberg kept the official neutron accounts and ensured that the final neutron economy would be solvent.

Although heavily preoccupied by the theoretical problems of the Hanford reactors, Wigner did not overlook the practical aspects of these novel facilities. He predicted that the intense hail of radiation in these reactors would damage the graphite structure, warping its dimensions and affecting its ability to conduct heat. Allowances were made in the design, so that when these effects actually occurred, operation of the Hanford reactors was not impaired. The damage to graphite caused by radiation is now known the world over by the wry name of the "Wigner disease."

Through the foresight, skill, and dedication of Wigner, Szilard, Weinberg and their associates at the Metallurgical Laboratory and the engineering genius of the duPont Company and its subcontractors, the Hanford reactors were built and operated with complete success. No one who has seen these massive structures standing isolated in the Washington desert, transmuting elements on an enormous scale and pouring their heat into the majestic Columbia River, can fail to have a sense almost of awe at this unprecedented achievement.

While the Hanford reactors were taking shape, Zinn turned his attention to improved reactors for research and designed and built the graphite-moderated reactor CP-2 (Chicago pile number 2) and the world's first heavy-water reactor, CP-3. After the war, when the Atomic Energy Commission made Zinn Director of the Argonne National Laboratory, he continued his brilliant development of new types of reactors. With the fundamental scientific information obtained from the early research reactors and the engineering experience accumulating from Hanford operations, it was possible for Zinn to attack the problems of harnessing nuclear energy for the production of useful power. He participated in the early development of pressurized water reactors which has made possible nuclear propulsion of ships and is being used in many of the nuclear generating stations now being built around the world. He designed and built two notable experimental reactors — the Experimental Breeder Reactor and the Experimental Boiling Water Reactor.

The Experimental Breeder Reactor was a daring innovation in many ways — it was the first high-power reactor to operate with touchy fast neutrons instead of the more tractable slow neutrons formerly employed, and it was the first reactor to be cooled by molten sodium. On December 20, 1951 the Experimental Breeder Reactor generated the world's first electric power from nuclear energy. Later, this reactor demonstrated that breeding with uranium was possible and thus established that abundant and cheap uranium-238 could be used as well as scarce and costly uranium-235 for the production of power. For the first time, man was assured of a practically unlimited source of energy.

The Experimental Boiling Water Reactor has proved beyond all doubt that steam can be generated in a nuclear reactor and used to drive a turbine with complete safety.

Many commercial power stations modeled on this reactor are now being built. To find the conditions under which boiling could be safely permitted to occur, Zinn conducted in the Idaho desert the first of the celebrated Borax experiments, in which a reactor was deliberately made more and more supercritical, until finally, in a dramatic and informative test, the reactor was permitted to destroy itself.

In these numerous, vital reactor projects, Zinn was far more than the director of the enterprise. He supplied insight and judgment during the engineering design stage and took his turn at the control console during operation. He combines those qualities of leadership, scientific acumen, and engineering skill which are essential in reactor development.

When the success of the Hanford reactors was assured, Wigner and Weinberg moved to Oak Ridge, where Wigner was named Technical Director of the Clinton Laboratory, later to become the Oak Ridge National Laboratory. These men recognized the importance of directing the knowledge of nuclear reactors gained during the war into normal civilian channels where it could be used in developing reactors for peaceful purposes. They organized the Oak Ridge School of Reactor Technology and helped found what Weinberg has called the "scholarly tradition in nuclear energy development." They performed a notable service to their scientific and engineering colleagues by presenting the results of their years of collaboration in the book The Physical Theory of Neutron Chain Reactors.

Wigner and Weinberg conceived the Materials Testing Reactor, the first of the high-flux reactors so useful in testing the effect of intense radiation on nuclear fuels and other reactor components. The plate-type, aluminum-uranium sandwich fuel elements which Wigner devised for this reactor are now being used in research and test reactors all over the world. After the new laboratory was well launched, Wigner returned to Princeton.

In 1955 Weinberg became Director of the Laboratory, where his leadership, enthusiasm and mastery of the reactor art have made the Oak Ridge National Laboratory one of the world's leading centers of reactor development. He has made the Laboratory pre-eminent in the development of fluid-fuel reactors and has conducted important experiments on the molten salt reactor and the aqueous homogeneous reactor. The fluid fuel used in these advanced reactor concepts can be charged, discharged or freed of fission products much more readily and economically than can the solid fuel used in other reactors.

I am sure that the four men being honored today would wish me to cite also the vital contributions to the development of nuclear reactors made by their scientific and engineering colleagues, far too numerous for individual mention here. The successful development of nuclear reactors has required the dedicated collaboration of workers from all over the world. But this occasion would not be complete without our paying tribute to Enrico Fermi, whose untimely death deprived the world of one of its greatest scientists. The "Italian Navigator" has left the stamp of his genius on all aspects of nuclear reactors.

Today, the technical feasibility of nuclear reactors has been established, in large measure through the efforts of these men. The main types of reactors have been devised and the principles of reactor engineering are well understood. Yet the full benefits of nuclear reactors are not yet being realized, because of the rather high cost of producing power and radioisotopes in them. I firmly believe that this delay in achieving the full potential of nuclear reactors is a temporary one, which will yield to further application of the qualities of theoretical insight, experimental skill, practical ingenuity and organizing ability, which served Szilard, Wigner, Zinn and Weinberg so well in bringing reactors to their present state of technical perfection. The world is fortunate that these men continue to devote their talents to the improvement of reactors. Under these circumstances, the day cannot be far off when nuclear reactors will make their full contribution to the welfare of mankind.

Introduction of

ISIDOR ISAAC RABI

by

JAMES R. KILLIAN, JR.

The Atoms for Peace Awards are international in character, and seek to underline the potential of science for drawing together in peaceful pursuits men of good will in all nations. Scientists in many countries have taken up the challenge to work toward this goal. One of these is our speaker today, a man whose contributions to our knowledge of physics and to international cooperation among scientists eminently qualify him to voice these aspirations. May I introduce to you Isidor I. Rabi, a member of this Academy, a member and former chairman of the President's Science Advisory Committee, Nobel laureate, and Professor of Physics at Columbia University.

SCIENCE AND PUBLIC POLICY

ISIDOR ISAAC RABI

Today there are being presented the 1959 and 1960 Atoms for Peace Awards. These awards are the third and fourth Atoms for Peace Awards and the first to be given to residents of the United States for scientific contributions made chiefly in the United States.

Since we are, so to speak, in the family, I need not dwell on the obvious merits and distinctions of these four men. I count each of them as a personal friend of 30 years' standing or more, except for Dr. Weinberg, who arrived on the scientific scene only a little more than 20 years ago. Dr. Zinn was actually a student in my graduate courses at Columbia University.

I wish now to extend to them my heartiest congratulations and to express my pleasure at the honor of being invited to make an address on this occasion when members of our intimate circle are being honored so greatly and so significantly.

The Atoms for Peace Award is a very special kind of award. Its very title suggests the profound perplexities of the postwar years. Combining the words "atoms" and "peace" combines science and politics, or science and statesmanship. The atom as such is neutral to human conduct or emotion. Peace was a goal dear to the human heart long before mankind had the knowledge to imagine such a thing as an atom. The conjunction of peace, the great hope of men in all nations, and the atom, the epitome of the advance of the knowledge of nature, is the mark of our time.

The Ford family, the founders of this Award, have a long tradition reaching back almost fifty years, of effort in the cause of peace. The older members of this audience will remember the gallant though unsuccessful attempts of Henry Ford to bring the First World War to an end. It would be a happier world today if his words, which seemed so utopian at the time, had been taken with the gravity which they deserved.

In establishing this Award, the Ford family had the dream of drawing the attention of the world to the possibilities of utilizing the great discoveries and applications of science, nuclear science in particular, to forward the cause of peace rather than war. The intention was noble and statesmanlike and expressive of the time at which the Award was first announced, the time of the first Geneva International Conference on the Peaceful Uses of Atomic Energy in 1955. That conference in itself was a blend of science and statesmanship such as had never been seen before.

The intervening five years have shown that science and peace do have a connection, not yet as great as science and war but certainly not negligible. The 1955 Conference on the Peaceful Uses of Atomic Energy marked the first massive confrontation of scientists from the Soviet bloc with their colleagues from the West. It opened an era of good feeling, mutual understanding, and respect between these two groups of scientists which has increased in time as more Americans have had the opportunity of visiting Russian installations and vice versa. This year, according to Professor Emilyanov, the Russians plan to send 40 scientists to the Rochester Conference on high energy physics. Last year we sent 60 to the Kiev Conference in the same field.

These contacts between scientists have led to an important amount of declassification of scientific and technical information. This declassification has not only enlarged the area of fruitful exchange of information with the East and with our own allies, but has also accelerated our own program because it made possible a freer flow of information.

Indeed one can say that science has provided an important bridge between the two rival blocs and a means for further peaceful cooperation for the lessening of tension and suspicion. Most scientists in the United States and in allied countries have regarded these advances toward a more open world as favorable omens for a future where the shadow of destructive warfare will hang less heavily over mankind. Most scientists have held this view, but not all.

A minority regards any lessening of tension as a prelude to a diminution of our effort in the development of atomic weapons and their means of delivery. In their view, safety can be achieved only by the development of atomic weapons to a degree which demands the utmost stretch of the imagination and by the most devoted effort. In this view no means are too large to apply to this end. They lay their hopes for peace paradoxically enough in a mutuality of terror which they feel would immobilize all aggressive impulses in the nations of the world. While the large nations are being held back from attacking one another by the certainty of annihilating retaliation, limited warfare according to this view could go on quite in the classical pattern without a great deal of disturbance. With sufficient effort, ''atomically'' advanced nations would in time possess stores of atomic weapons so cheap and so plentiful that they could overcome the resistance of less advanced nations with the same ease with which the Spaniards conquered Peru.

My pictures may be sharply drawn but no one who has followed the discussions will suggest that the positions taken by the two sides are caricatured beyond recognition. Granted that my description has some relation to reality we ask ourselves what is the course of wisdom in the midst of these divided counsels. How should the atom and peace be conjoined so that our young people may see a future before them where, at the end of the rainbow, there awaits something more pleasant than a huge super nuclear explosion?

The solution to the dread problems posed by the advances of science and technology can certainly not be found by the scientists alone. Just as certainly these problems can not be solved by men who have little or no knowledge of science or technology, however great the responsibility which has been thrust on them either by election or by appointment. Even a combination of the best brains in our country from all fields of experience (science, business, religious and ethical as well as the academic and political) is hardly equal to the task of mapping a wise and safe course through this tangle of mistrust and terror which has grown up in the postwar years.

We must find a way through this thicket of charge and countercharge where reason and common sense can prevail in the end.

The history of the efforts to prevent a runaway catastrophe in the use of atomic weapons begins back in 1946 with the Acheson-Lilienthal report. It goes on to the Baruch proposals, later modified to be the United Nations proposal for the control of atomic energy. When these measures failed there was a quiescent period in which the Soviets acquired the atomic bomb which was followed by the U. S. thermonuclear bomb and again by the Soviet thermonuclear weapon.

In 1955, during the Geneva Conference on the Peaceful Uses of Atomic Energy I was asked to represent the U. S. in a discussion with the Soviet representative on the question of safeguards which might be devised so that the spread of the peaceful uses of atomic energy would not be a danger to peace through the diversion of bomb material. Dr. Wigner and Dr. Zinn were together with me in this enterprise. The discussions hinged on the existence of an agency to be formed as suggested by President Eisenhower. This agency, the International Atomic Energy Agency, is now in existence but the dangers to the peace have not diminished and as was to be expected our meeting ended in a moral victory for us but actually in failure.

It is customary to lay the blame for the failure of these and subsequent attempts on the backs of the Russians. And indeed I would be among the last to deprive them of their proper share of the blame, which is large. But we too are not blameless. Although we can not do much about reforming the Russians, we ought to be able to take steps to set our own house in order.

Those of us who travel abroad and have the problem of representing the United States in one way or another are often taken aback at the degree and intensity of criticism which is directed both at our actions and at the statements of some of our political figures. No such intense criticism is directed at the Soviet Union for acts compared with which our own slips would seem to be minor. At first sight this criticism which holds us to a stricter accounting seems unfair. However if one probes more deeply this attitude is quite natural.

We must understand that we occupy an entirely different position in the world from the Russians. The United States is indeed the leader not only of the Western world but, to an extent greater than we realize, the United States is the leader of the whole world. Beneath the scoffing, mocking, and hostility of the Communist world there is nevertheless a deep respect. America is the ideal not only materially but in most elements of existence which human beings share in common. If America were to disappear there would be no embodiment of the Russian goal, no one to catch up with and surpass. For these reasons, when we fall short of the high standards which we and the world have set for us the failure is felt very deeply. The elevated and rarefied moral atmosphere in which we are supposed to live may be a bit hard on us plain folks here at home but it is the role which we have assumed and the role which we have to play.

If one can be certain of anything in the uncertain course of events in this decade, the moment the United States stops supplying leadership, the world, as we know it, will disintegrate and fragment into chaos with no one but the Russians to pick up the pieces. We therefore have a moral obligation to be wise in order to guide ourselves and others, and to be prosperous so that we can spare from our own supplies to help others. We seem to have found a way to be prosperous and now we ask ourselves how we can cultivate wisdom in policy and action, especially in the field of atomic energy for war and peace, which is so central to all our problems.

As I review in my mind the 15 years which have passed since the end of the war I am forced to the conclusion that very many of our difficulties stem from one fundamental distortion of our natural habit: the distortion caused by the exaggerated secrecy in the military field and in the atomic field especially. You will all agree that these fields are central to our problems of foreign and domestic policy but you may well ask why I regard secrecy which seems so necessary to be at the same time so very damaging.

The answer lies in our history and our tradition. We are a pluralistic society dedicated to a distribution both of authority and responsibility. From the President of the United States on down we have been against concentration of power here in Washington. The pressure of events has compelled a greater and greater concentration of such powers, but they have been granted most grudgingly. To some, the weakness of our central government is a source of regret, but there is no doubt as to the general public feeling. Washington is and always has been suspect.

Although the Constitution vests control of foreign policy firmly in the hands of the President, in actual fact the President does not operate in a vacuum. He must share his responsibilities with the Senate and with the House of Representatives. Agencies of the government in addition to the Department of State are directly concerned; the Department of Defense, the Atomic Energy Commission are only the most important. Beyond these there are other agencies but almost as important are the press, the daily, weekly, and monthly periodicals, TV and radio. Beyond these are the opinion makers in the universities, the labor unions, in large and small business and, of newer importance, the scientists and experts of every variety.

Policy comes out as a harmony produced by all these interacting forces. This has been the American tradition and practice. Now, what happens when secrecy intervenes? Pathetic and profound ignorance of the facts does not prevent the policy makers inside and outside of government from carrying on in the field of atomic energy as if all were clear to them. They gather a rumor here, a leak there, and off they go. Ignorant or learned, they take a stand and public opinion is formed.

Our government can not act strongly without ample support from public opinion. For wise action an informed public opinion is necessary. When secrecy intervenes, an informed public opinion can hardly exist. Too often we have instead a manipulated public opinion formed by leaks, half truths, innuendoes and sometimes by outright distortion of the actual facts.

We can now ask ourselves, what have we really gained from our exaggerated secrecy in the way of real security? Actually very little. The Russians are not far behind us in atomic weapons but our allies have been left way behind after expending an enormous treasure in trying to rediscover facts and techniques already known to the Russians as well as to ourselves. The secrets of military technology must be as highly protected as any trade secrets but only as long as they are real secrets. In most cases this time is measured in years rather than decades. Although most policy makers, amateur or professional, are not deeply interested or capable of judging the technological situation, secrecy results in frustration, doubt, and timidity about the exercise of any independent judgment. The result has been that a number of less inhibited men of greater or lesser scientific or technical accomplishment but with a low boiling point have been gaining the public ear on the basis of prestige acquired through a technical accomplishment, quite limited in scope. Their policy statements are given weight on the basis of skills not necessarily relevant to the dread subjects of war and peace which they discuss with easy confidence. Were it not for the mantle of secrecy which surrounds the hard core of the matter, the intelligent public would be quite capable of judging the questions under discussion. The fear of being guilty of a judgment based on a partial knowledge of the facts misleads many judicious people into accepting judgments by others whose knowledge is often even more partial but which extends into the dread domain of the top secret.

The questions which should concern the informed non-technical general opinion are rather such as: How many weapons do we actually have? What are their means of delivery? What are the effects of these weapons? What is the composition of the stockpile in the range of yields and sizes? How much do they cost? Who controls them and by what means are they controlled? What are claimed to be the further needs for nuclear and other weapons and what is the justification? What do we know about the state of the art in other countries?

The answer to every one of the questions falls under a high degree of classification. Some of them have this classification for very good reasons and others merely from force of habit. One can nevertheless ask, "How can the publisher, the editor, commentator or editorial writer of an important organ influential in informing and shaping public opinion carry on in an intelligent way without a fairly full knowledge of these and other facts?"

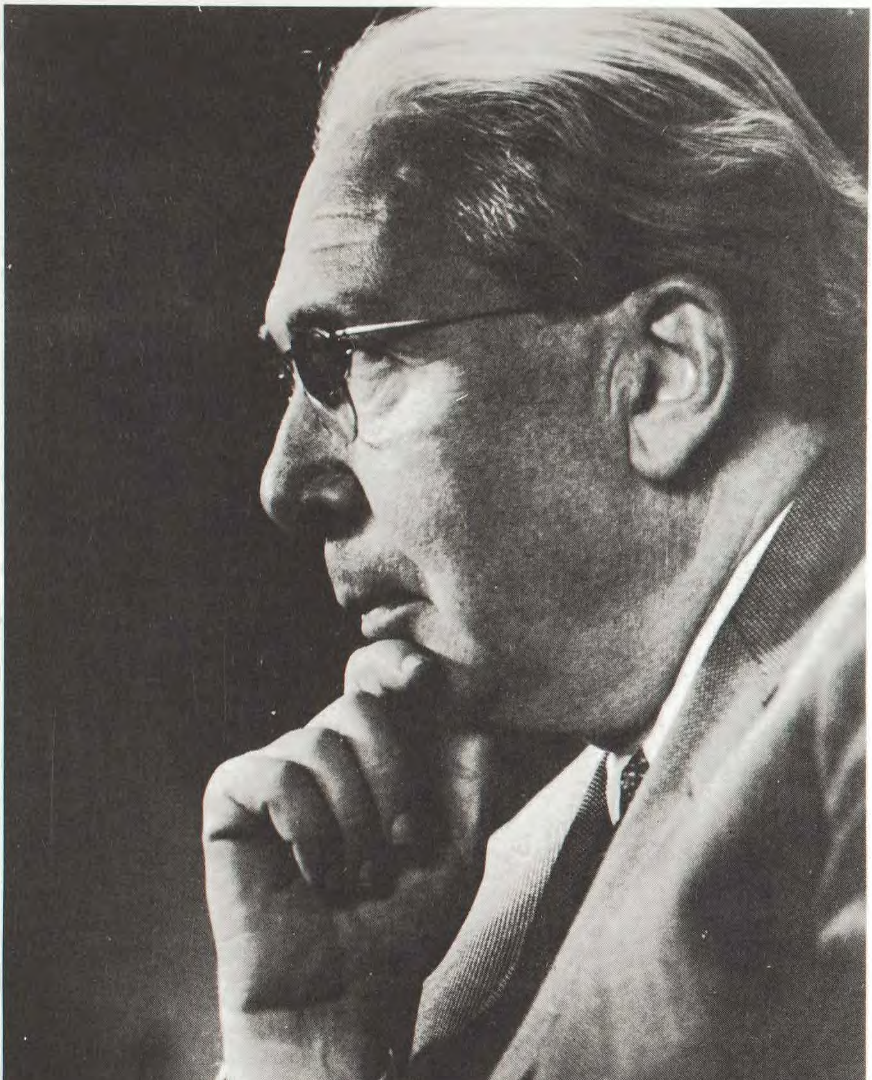
We are now engaged in tripartite negotiations with the Soviets and the United Kingdom on a test suspension coupled with a system of inspection. Clearly, this is a most delicate matter perhaps best left to the wisdom of the President and his most trusted advisers. It is his job and his duty as set forth in the Constitution. Nevertheless, it has not been left to the President, and public debate, which impairs the freedom of action of the President, rages over the land. This would be just the right thing if the debate were well informed. We were not brought up as a nation to believe that father knows best. Unfortunately the debate is not well informed and becomes more of a conflict of pressure groups rather than a quest for clarity and wisdom.

I hope I have made my point that to live at peace with the atom we must find our way back to the fundamental principles on which this republic was founded. We must again become a nation of free men informed by a free press. Since the very beginning we have been told that this is a dangerous doctrine. In about a century and three quarters of national existence we have learned to live dangerously in a dynamic society. Totalitarian countries preserve their secrecy by regimenting their people, giving them neither freedom of travel, freedom of the press, freedom of conscience, or freedom of opinion. Some may envy their secrecy but no one will envy their lives.

In closing I again wish to congratulate the four recipients of the Atoms for Peace Awards. They are the symbols today of the vision of President Eisenhower and of the Ford family who embodied this vision in the substantial form of these awards. We hope that this vision will remain bright as it must because it is a vision of sanity, of reason, of justice, and, most of all, it is a vision of peace and cooperation among men.

C I T A T I O N S

R E S P O N S E S



THE CITATION

LEO SZILARD: By your wide-ranging interest in science and in the implications of scientific advance for human welfare, you have made significant contributions to man's search for knowledge and for peace.

Your studies of the nature of nuclear reactions led to an anticipation of the possibility of producing useful power by using the forces within the atom. With colleagues, some of whom we also honor today, you carried these studies to the attainment of the controlled nuclear chain reaction—the basis of the rapid development of atomic science in the past two decades.

By your zeal and devotion to your work, you attracted promising young scientists to the new field and imbued them with your vision of its potentiality.

You have been untiring in your efforts to arouse men of all nations to the social and political implications of atomic energy.

May this medal, symbolizing the Atoms for Peace Award, signify to all men the importance of your contributions "for the benefit of mankind."

RESPONSE

LEO SZILARD

In 1913, one year before the first World War, H. G. Wells published a book entitled "The World Set Free" in which he predicts the discovery of artificial radioactivity and puts it into the year of 1933, the year in which it actually happened. In this book Wells describes how this discovery is followed by the release of atomic energy on an industrial scale, the development of the atomic bomb and a world war which is fought with such bombs. London, Paris, Chicago and many other cities are destroyed in this war, which Wells puts into the year of 1956. I read this book in 1932, before I myself had done any work in the field of nuclear physics.

In 1933, I went to live in London. In the fall of that year, the London papers reported a speech given by Lord Rutherford at a meeting of the British Association in which he said that whoever talked of the release of atomic energy on an industrial scale was talking moonshine. I was pondering about this while strolling through the streets of London. On that occasion, it occurred to me that Rutherford might be wrong, because there might exist an instable element that splits off neutrons when bombarded by neutrons and such an element could sustain a nuclear chain reaction. On the basis of the published masses of helium and beryllium, the beryllium nucleus should have been instable and it could have disintegrated into two alpha particles and one neutron, when hit by a neutron.

At this time, I was playing with the idea of shifting to biology. But the possibilities opened up by these thoughts were so intriguing that I moved into nuclear physics instead.

In the summer of 1934, T. A. Chalmers and I looked into the mystery of beryllium and found that beryllium emits neutrons when exposed to the gamma rays of radium. Other experiments showed, however, that gamma rays of lower energy were incapable of splitting beryllium and this made it appear doubtful that beryllium could sustain a nuclear chain reaction.

Nevertheless, the thought that some element or other might be capable of sustaining such a chain reaction stayed with me and I pursued it from time to time without success until I finally gave up hope in the fall of 1938. In December of 1938, I so advised the British Admiralty, to whom I had previously assigned a secret British patent which described the general laws governing nuclear chain reactions. One month later, I visited Wigner, who was ill with jaundice in Princeton. On that occasion I learned from him that Hahn and Strassman had found that the uranium nucleus breaks into two heavy fragments when it absorbs a neutron. To me, it appeared at once very likely that these fragments would evaporate neutrons and this meant that uranium might sustain a chain reaction. "H. G. Wells, here we come!" — I said to myself. Neither Wigner nor I had much doubt at that time that we were on the threshold of a World War. Finding out whether neutrons are emitted in the fission of uranium appeared to us, therefore, as a matter of great urgency.

The rest is history.

In 1945, as the war drew to its end, one of the younger staff members came into my office at the Uranium Project at the University of Chicago and said that he felt it was a mistake that so much emphasis was placed on the bomb and that we were not paying sufficient attention to the peacetime applications of atomic energy. "What particular peacetime applications do you have in mind?" I asked him, and he said, "The driving of battleships."

I often told this story after the war as a joke. These days, when we are rapidly moving towards the long range rocket stage of the so-called atomic stalemate, it seems to me that the story is even better, because it now represents two jokes rather than just one.

It is not always easy to say what is or is not a peacetime application of atomic energy, but if the large-scale liberation of atomic energy which we have achieved abolishes war, as it well may, the distinction will cease to be important. If war is to be abolished, the nations of the world must either enter into a formal agreement to get rid of the bomb or they must reach a meeting of the minds on how to live with the bomb. So far, we have not made much progress in either direction. It seems likely, however, that, as far as America is concerned, she will be forced to decide in favor of one or the other of these two alternatives during the term of office of the next President, and either decision might be better than no decision.

THE CITATION

EUGENE PAUL WIGNER: By bringing to the early work on nuclear chain reactions and on nuclear reactors your wide knowledge of engineering and chemistry in addition to your theoretical and experimental skill in the physics of the atom, you contributed greatly to that combined effort of men of many disciplines which has given us the practical gifts of atomic power.

By joining with other scientists of vision in the time of danger, you contributed greatly to the implementation of the research and development which led directly to the first controlled nuclear chain reaction.

By maintaining a lively interest in the potential of atomic power and concern for its best use for the good of all men, you have served to encourage new and serious evaluations of the place of science and technology in the modern world.

By teaching and by directing important research projects, you have contributed to our understanding of nature and to our ability to use nature for the improvement of man's physical environment thus augmenting man's dignity by augmenting his understanding.

May the Atoms for Peace Award signify to you the recognition by men and women throughout the world of your contributions "for the benefit of mankind."

RESPONSE

EUGENE PAUL WIGNER

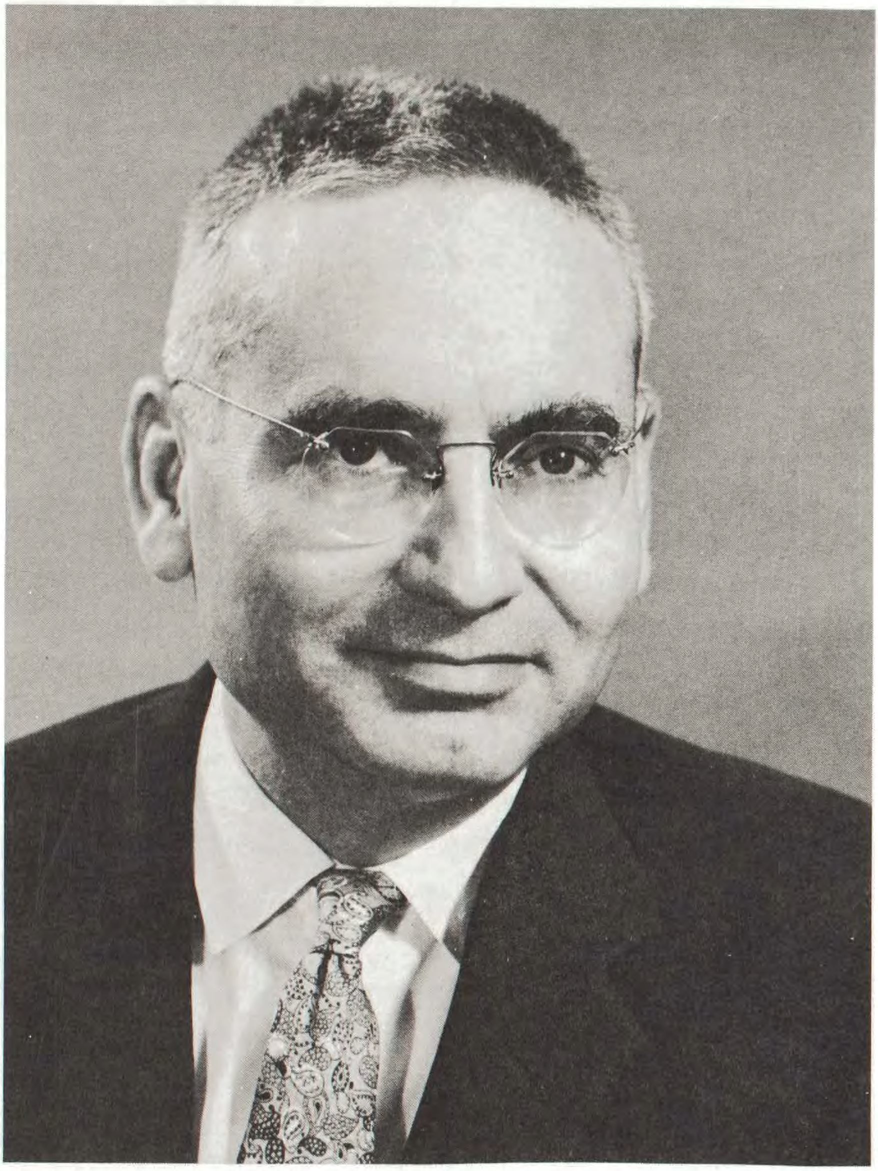
I feel deeply conscious of the great honor which was bestowed upon me and also sincerely grateful that it is Leo Szilard with whom I am sharing it. It was he who provided the original stimulus for my interest in nuclear energy and his foresight was a steady beacon in the early days of the work on nuclear reactors.

Dr. Szilard spoke about the past; I would like to say a few words about the objectives of the movement which is so generously supported by the Foundation whose guests we are, about the objectives of the Atoms for Peace movement. The present awards reward contributions to the development of nuclear reactors and we are firmly convinced that reactors are destined to play a significant role in furthering the material well-being of man. However, it would be a mistake to interpret the Atoms for Peace movement solely in terms of nuclear energy. Man does not live by bread alone and the first need of our time is a greater willingness to curb those of our desires, chiefly in the political field, the realization of which would cause suffering to others. The curbing of these desires, the attempt to reconcile and even harmonize conflicting wishes is what is termed, somewhat anemically, international understanding.

It is my firm conviction that the atom's role will be as significant by fostering mutual good will among nations as by relieving economic want. Atoms not only demonstrate the challenge and power of man's greatest international enterprise, of science; their study also shows ways for active and vigorous cooperation. Such cooperation, toward definite goals, is the only known means for men of widely different backgrounds to establish the community of spirit, the consideration for each other's motives and sensitivities, which the world needs more than anything else.

There is another goal toward which international scientific cooperation guides us: Openness, willingness to share our knowledge with others. As long as we remain far from this goal, true cooperation will be impossible and suspicion will thrive where trust and confidence should prevail. It is a constant source of pride for me that our country has shown the way toward openness, that it was the first to give freely to the world, through the Atoms for Peace program and otherwise, information which it was very tempting to conceal. May all other nations want to surpass us in this regard to the same extent that they wish to surpass us in wealth and power.

I cannot close my remarks better than by repeating the words of Niels Bohr which John Wheeler quoted, at the first presentation of this award, to Niels Bohr. "The efforts of all supporters of international cooperation, individuals as well as nations, will be needed to create in all countries an opinion to voice, with ever increasing clarity and strength, the demand for an *open world.*" May the Atoms for Peace movement help us toward this objective.



THE CITATION

ALVIN MARTIN WEINBERG: For your sustained contributions to the development of nuclear reactors, beginning with your participation in the early work at Chicago and still continuing productively;

For your contributions to the understanding of the theoretical problems posed in the study of the nucleus;

For your leadership in the development of experimental reactors and their evaluation;

For your guidance and counsel to workers in the field of nuclear energy and for your constructive contributions to the formulation of national scientific policies bearing upon the peaceful uses of atomic energy;

The Atoms for Peace Award is given. May it signify to all people the recognition of the importance of your work "for the benefit of mankind."

RESPONSE

ALVIN MARTIN WEINBERG

It is with a deep sense of gratitude, not to say awe, that I accept this great honor. Because of my relative youth I am the first recipient of this award whose scientific life has coincided with the post-fission era, and who has devoted practically his whole career to the exploitation of Hahn and Strassman's discovery. As such I am perhaps more aware than most of the full extent to which large-scale development of nuclear reactors is a group effort, and how small can be the contribution of any single individual. In accepting this award I can therefore do, at best, inadequate justice to the many scientists and engineers who are my colleagues at the Oak Ridge National Laboratory, and whose dedication, ingenuity, and faith are really being honored here.

I must also mention the extraordinary debt which I owe to my close friend and teacher, Eugene P. Wigner. Much of what we at Oak Ridge have been trying to do in our heavy nuclear development over the years is built upon a tradition of scholarship and of pointed practicality which we have learned from our former Research Director, Professor Wigner.

Although the work of developing an ultimate, permanent, and economical energy source based on fission is still unfinished, we are beginning to see ways of achieving this crucially important technological goal. Should we succeed in our efforts, it will be the great good fortune of our scientific generation to be able to give to posterity an adequate and permanent supply of the most fundamental raw material:—energy. That a world no longer beset by fears of energy shortages will inevitably be a more stable and peaceful world, we who work on nuclear energy development deeply believe. It is this vision of an abundant and peaceful world which inspired the efforts of the men to whom the award is dedicated; it is toward the achievement of this vision that the Atoms for Peace Award will continue to inspire reactor technologists everywhere.

THE CITATION

WALTER HENRY ZINN: In the development of nuclear chain reactions from a theoretical concept to the threshold of the wide spread use of nuclear reactors for research and for power, your contributions have been many.

With Leo Szilard, you observed the release of neutrons during the fission of uranium, an observation sought and obtained by others at the same time. This observation demonstrated the possibility of the chain reaction which is the basis of the reactors.

You participated in the experiment which resulted in the first controlled nuclear chain reaction.

You have been a leader in the design, construction, and evaluation of experimental reactors which have supplied improved methods and essential data for the worldwide utilization of atomic energy through the medium of power generation, research facilities, and isotope production.

May the Atoms for Peace Award signify to you the awareness of people throughout the world of the importance of the contributions you have made "for the benefit of mankind."

RESPONSE

WALTER HENRY ZINN

Seventeen years have passed since the research work of many scientists over many years culminated in an experiment in which, for the first time, man secured control over the release of the vast energy of the atom. At that time, the possible beneficial uses of this new form of energy were the subject of very considerable discussion and speculation.

The general opinion of the individuals directly associated with the experiment was that the important applications would be as a source of radiation for research in the physical and medical sciences and as a new source of energy for electricity generation.

None of us foresaw the extent to which establishments for research in the wholly peaceful applications of atomic energy would be created as a result of the impact of atomic energy on the minds and imaginations of people everywhere. The scientific results already obtained in these establishments by using research reactors and radioactive materials are indeed impressive, and I suppose we see only the very beginning of this work. Perhaps still more important is the fact that these atomic energy establishments are serving as centers to which scientists from many countries travel to make use of unique facilities, thus re-establishing the atmosphere of free association and collaboration which is fundamental to the spirit of science.

Substantial progress has been made in the application of the nuclear reactor to electrical power generation, and large nuclear power plants are in operation in a number of countries. No one can say just when nuclear energy will produce the abundant and inexpensive electrical power it inherently promises, but the world-wide concerted attack on this difficult technological problem suggests that success will be achieved, and in ample time to replace our diminishing fuel resources.

I have had the opportunity to see firsthand the rapid evolution of diverse and complicated machines from that early pile of graphite and uranium building blocks. Formidable technical problems which in earlier times would have taken decades to solve have yielded quickly to the power of the modern research laboratory complex. One can only express regret that the political problems created by atomic energy have not, as yet, been solved. We must all join in the hope that the United Nations, in time, will develop the strength, based on world-wide cooperation, to deal with political problems with the same speed and competence we expect from our laboratories in solving physical problems.

An extensive new technology and industry have developed from the first efforts to make a nuclear chain reaction. It has required the dedicated work of many talented scientists and engineers, and I wish to acknowledge the great privilege which has been mine to have worked so closely with so many of them.

I am deeply grateful, Mr. President and Trustees, in being named co-recipient of the Atoms for Peace Award. I am greatly honored that the Award commemorates the memory of Henry and Edsel Ford whose vision and pioneer work have contributed so much to the development of our modern industrial society. I have high hopes that atoms for peace will similarly enrich the life of man.

ATOMS FOR PEACE AWARDS, INC.

The Biological Laboratory
of the
Long Island Biological Association
Cold Spring Harbor, New York

Annual Meeting of Members and Friends
on Sunday, September 18th, 3 to 6 o'clock

Talk at 4:30

Professor Leo Szilard
Enrico Fermi Institute for Nuclear Studies
University of Chicago

"The Problems Posed by the Bomb"

Tea

ATOMS FOR PEACE AWARDS, INC.

A MEMORIAL TO
HENRY FORD AND EDSEL FORD

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Archives

FOR RELEASE: A.M. NEWSPAPERS
WEDNESDAY, APRIL 6TH

FOUR AMERICAN SCIENTISTS NAMED FOR ATOMS FOR PEACE AWARD.

Four American scientists were named today as recipients of the Atoms for Peace Award. Leo Szilard and Eugene P. Wigner will share the 1959 Award. Walter H. Zinn and Alvin M. Weinberg will share the 1960 Award. All have been active in the development of nuclear reactors.

Each man will receive a gold medallion symbolizing the Award and will share equally in the combined honorarium of $150,000. The Awards will be presented at a ceremony to be held at the National Academy of Sciences, Washington, D.C., on May 18.

In making the announcement, Dr. James R. Killian, Jr., Chairman of the Trustees of Atoms for Peace Awards, said, "The Trustees believe the development of the nuclear reactor is one of the great advances in man's capability for using atomic energy for peaceful purposes. It gives the world a new source of energy with which to meet the growing requirements of modern society for power to run its machines. As a source of radio-isotopes, it is now providing science and industry with new possibilities in research and control, as well as with new products. The transformation of a highly complex, theoretical concept of 1939 to the multitude of reactors operating today in research and in commercial establishments is a major achievement of modern science and engineering. The men who are selected for recognition by this Award have been leaders in that transformation. Dr. Szilard and Dr. Wigner, both working in the area of nuclear physics, were early advocates of a concerted effort to study the possibilities of nuclear chain reactions. Their interest and concern resulted in the well-known letter of the late Albert Einstein to President Roosevelt which noted that 'the element uranium may be turned into a new and important source of energy in the immediate future'. These two men held an influential place in the work which resulted in the first nuclear chain reaction and in the subsequent applications of that significant development. Dr. Zinn and Dr. Weinberg participated in the early work and have continued to make important contributions in the field of reactor design and in the administration of research and development efforts in this area."

The Award was established as a memorial to Henry Ford and his son, Edsel, in response to President Eisenhower's 1955 appeal at Geneva for international efforts to develop nuclear energy for peaceful purposes. It is to be granted "solely on the basis of the merit of contribution, whereever found in the world and without regard for nationality or politics." Earlier recipients of the Award were Niels Bohr of Copenhagen, Denmark and George C. de Hevesy of Stockholm, Sweden. Nominations for the Award have been received from persons and learned societies in 24 countries.

Leo Szilard, a native of Hungary, was educated in Budapest and Germany, earning his doctorate at the University of Berlin in 1928. After teaching and research in Germany and England, he came to the United States in 1937, joining the Faculty of Columbia University. In 1942, he moved to the University of Chicago as chief physicist in the Metallurgical Laboratory, a special research group organized to develop the potential of nuclear reactions under government auspices. Since 1946 he has been Professor of Bio-Physics at Chicago. Among his contributions are development of the field of radiation chemistry and (with Dr. Aaron Novick) new methods of control of the culture of micro-organisms, making possible significant discoveries in the science of genetics. With the late Enrico Fermi, he was awarded the patent for the first nuclear reactor. He was recipient of the Albert Einstein Medal for 1960.

Eugene Paul Wigner, also born in Hungary and educated there and in Berlin, came to the United States in 1930. Except for a period at the Metallurgical Laboratory of the University of Chicago and as Director of the Oak Ridge National Laboratory, he has been a member of the faculty of Princeton University, having been named Thomas B. Jones Professor of Mathematical Physics in 1938. He is the co-author of books on nuclear reactors and on nuclear structure. He is a member of the National Academy of Sciences and has been recipient of the Medal of Merit, the Franklin Medal, and the Fermi Award in 1958.

Alvin M. Weinberg is a native of Chicago and a graduate of the University of Chicago, having earned his doctorate there in 1939. From teaching in that university, he joined the Metallurgical Laboratory in 1941. In 1945, he transferred to the staff of the Oak Ridge National Laboratory of Oak Ridge, Tennessee, where he has been Director since 1955. He has been active in the design of reactors, notably the homogeneous reactor. With

Dr. Wigner, he is the author of an authoritative text on nuclear reactors.

Walter H. Zinn, a native of Canada, earned his doctorate at Columbia University and served on the faculty of the City College of New York from 1932 to 1941, when he, too, joined the Metallurgical Laboratory at the University of Chicago where he was a member of the team that constructed the first successful atomic pile. He designed and built the first heavy water reactor. From 1946 to 1956 he was Director of the Argonne National Laboratory at Lemont, Illinois, where he was actively engaged in the development of the fast breeder reactor and the boiling water reactor. He is at present vice-president of Combustion Engineering, Inc. He is a member of the National Academy of Sciences.

The Trustees of the Atoms for Peace Awards are James R. Killian, Jr., Detlev W. Bronk, Robert F. Bacher, Ralph J. Bunche, Arthur H. Compton, Mervin W. Kelly, Robert F. Loeb, Robert A. Marshak, Charles Allen Thomas, and Alan T. Waterman.

ATOMS FOR PEACE AWARDS, INC.

A MEMORIAL TO
HENRY FORD AND EDSEL FORD

77 Massachusetts Avenue, Cambridge 39, Massachusetts
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FOR RELEASE AFTER DELIVERY
4:00 P.M., WEDNESDAY, MAY 18, 1960

Text of an Address by

MANSON BENEDICT

Professor of Nuclear Engineering

Massachusetts Institute of Technology

PRESENTATION OF THE ATOMS FOR PEACE AWARDS

to

LEO SZILARD and EUGENE P. WIGNER

ALVIN M. WEINBERG and WALTER H. ZINN

The National Academy of Sciences

Washington, D. C.

Wednesday, May 18, 1960

3:00 p.m.

"THE ROLE OF THE AWARD WINNERS IN REACTOR DEVELOPMENT"

Today we honor the four men who, of all men living, have done most to originate and perfect the nuclear fission chain reactor, Leo Szilard, Eugene Wigner, Walter Zinn and Alvin Weinberg. It is appropriate that the fission chain reactor be the central theme of the occasion, because it alone, of all devices thus far conceived, provides a practical means for utilizing the energy of the atomic nucleus and producing radioisotopes in abundance. These gifts of the atom, if used wisely, will be of inestimable benefit to mankind.

In these days when nuclear reactors have become common-place it is easy to overlook the absolutely revolutionary character of these devices. Let us not forget that in the nuclear fission chain reactor mass is converted into energy in a controlled manner, and the alchemist's dream of transmuting one element into another is at last realized. A generation ago no one conceived that the practical means for carrying out these processes would be devised so soon through the inspired work of these four men and their scientific and engineering colleagues.

Leo Szilard seems to have been marked by destiny to develop the nuclear reactor. After leaving his native Hungary he served as Einstein's assistant in Germany. We may imagine that he here acquired a keen appreciation of the enormous amount of energy locked up in the mass of the atomic nucleus. At a more practical level, we may note that Szilard and Einstein invented an electromagnetic pump for liquid metals, which many years later proved useful in nuclear reactors. Subsequently, Szilard went to England, where he investigated many schemes for utilizing the energy of the nucleus, but found none then that were workable. Szilard paid special attention to the production of neutrons in nuclear reactions, for he realized that if a neutron-induced reaction could be found in which more neutrons were produced than were consumed, the key to unlocking the energy of the nucleus might be at hand. He came to Columbia University, and there in 1938 he learned of Hahn and Strassman's discovery that neutrons cuased uranium to undergo fission. It was realized at once that fission would release tremendous amounts of energy, and there was good reason to believe that neutrons might also be produced. Here might be the long-awaited chain reaction from which the energy of the nucleus could be tapped.

Szilard enlisted as collaborator the young Canadian physicist, Walter Zinn, then on the faculty at the City College of New York. The two men devised an experiment to measure the number of neutrons produced when a uranium atom undergoes fission with slow neutrons. The rough result, of two fast neutrons produced per fission, seemed promising, but the question remained whether it provided sufficient margin to allow for non-fission absorption of neutrons by uranium and other materials while fast neutrons were being slowed down to the point where they could continue the fission chain reaction.

Szilard quickly recognized that graphite was one of the best materials to slow down neutrons because it absorbed so few neutrons, and that the neutrons would have a better chance of escaping capture by uranium if the uranium were in lumps spaced evenly throughout the graphite rather than mixed intimately with it. He foresaw the importance of using the purest possible graphite and uranium. He discussed these points with Enrico Fermi, who was also experimenting with uranium at Columbia. These men devised the now-classic experiment to measure the multiplication factor of such a graphite-uranium lattice. If conditions could be found under which the multiplication factor could be made greater than unity, a chain reaction with these materials would be possible; if less than unity, the process would not work.

At the same time Eugene Wigner, Professor of Theoretical Physics at Princeton University, was also deep in calculations of the conditions under which a neutron chain reaction in uranium might be made to take place. Wigner was a fellow countryman of Szilard's and an authority on the symmetry properties of molecules, atoms and nuclei and the resonance absorption of neutrons. Szilard, Fermi and Wigner exchanged ideas freely and in a series of weekly conferences at Princeton planned and interpreted the historic experiments on graphite and uranium being conducted at Columbia.

The reports of this period give us some appreciation of the primitive conditions under which this early work was carried out and the excitement which the experimental results inspired. In Pupin Physics Laboratory of Columbia University, Fermi and Zinn pressed hundreds of pounds of uranium oxide powder into lumps and sawed tons of graphite into bars. Stacking the piles of these materials was hard, dirty work, an incongruous activity for a university in the heart of New York City. Yet the experimenters had their reward as they learned how to increase the multiplication factor from experiment to experiment, until by late 1941 it seemed that a value above unity might be attainable. With a sufficient quantity of highly purified uranium and graphite, a nuclear chain reaction should be possible.

Meanwhile, the indefatiguable Szilard, from the purposeful clutter of his small room at the King's Crown Hotel, wrote letters and reports and did everything possible to ensure the success of the experiments. He developed the theory of uranium-graphite lattices and suggested new experiments. He inquired into supplies of uranium and sought purer materials. Szilard's pioneering efforts in these early days were recognized many years later by the award to him and Fermi of the basic U.S. patent on nuclear reactors.

During this period Szilard was just as active in the political sphere as in the technical. He sought and obtained the support of the U.S. government for the uranium project by characteristic direct action. With Wigner he acquainted Einstein with the possibilities of the project and provided Einstein with the information the latter used in his now famous letter to President Roosevelt.

In early 1942, wartime necessity dictated that work on the uranium project be centralized at the University of Chicago under the direction of Arthur Compton, and its pace greatly accelerated. At this time Fermi, Szilard and Zinn moved to Chicago, where, in less than a year, they completed successfully one of the world's most celebrated experiments. With Fermi in charge of the work, Zinn built the world's first nuclear reactor, using pure graphite and uranium provided through Szilard's foresight. In a squash court under the West Stands of Stagg Field in the heart of Chicago, on December 2, 1942, this pile of graphite and uranium went critical and ushered in the atomic era. To Compton's famous coded telephone message to Conant, "The Italian navigator has just landed in the new world," we should add that the vessel used by the Italian navigator was built by a Canadian shipwright from rare and costly materials found by a Hungarian explorer.

In the summer of 1942, Wigner also came to Chicago, to take charge of the theoretical division of the laboratory. When the decision was made to build the Hanford reactors, which were to be the world's first transmutation factories, Wigner was placed in charge of their design. As experimental results were obtained by Fermi and Zinn, the group headed by Wigner incorporated them into the design of the Hanford reactors. Wigner is responsible for the wise choice of water cooling for these reactors, an engineering decision that did much to ensure their success. Szilard, with his usual foresight, saw the need for intensive efforts on the fabrication of uranium metal and the development of aluminum cladding and helped assemble the group of metallurgists who perfected these operations.

An important member of Wigner's theoretical group was a young Chicago physicist, Alvin Weinberg, whose function in these busy days was to be the "Czar of k," the keeper of criticality calculations. Would the introduction of aluminum for cladding and water for cooling absorb so many precious neutrons that the pile would not go critical? Would the fractional parts per million of boron left in the ultra pure uranium and graphite poison the reactors? Weinberg kept the official neutron accounts and ensured that the final neutron economy would be solvent.

Although heavily preoccupied by the theoretical problems of the Hanford reactors, Wigner did not overlook the practical aspects of these novel facilities. He predicted that the intense hail of radiation in these reactors would damage the graphite structure, warping its dimensions and affecting its ability to conduct heat. Allowances were made in the design, so that when these effects actually occurred, operation of the Hanford reactors was not impaired. The damage to graphite caused by radiation is now known the world over by the wry name of the "Wigner disease".

Through the foresight, skill and dedication of Wigner, Szilard, Weinberg and their associates at the Metallurgical Laboratory and the engineering genius of the duPont Company and its subcontractors, the Hanford reactors were built and operated with complete success. No one who has seen these massive structures standing isolated in the Washington desert, transmuting elements on an enormous scale and pouring their heat into the majestic Columbia River, can fail to have a sense almost of awe at this unprecedented achievement.

While the Hanford reactors were taking shape, Zinn turned his attention to improved reactors for research and designed and built the graphite-moderated reactor CP-2 (Chicago pile number 2) and the world's first heavy-water reactor, CP-3. After the war, when the Atomic Energy Commission made Zinn Director of the Argonne National Laboratory, he continued his brilliant development of new types of reactors. With the fundamental scientific information obtained from the early research reactors and the engineering experience accumulating from Hanford operations, it was possible for Zinn to attack the problems of harnessing nuclear energy for the production of useful power. He participated in the early development of pressurized water reactors which has made possible nuclear propulsion of ships and is being used in many of the nuclear generating stations now being built around the world. He designed and built two notable experimental reactors - the Experimental Breeder Reactor and the Experimental Boiling Water Reactor.

The Experimental Breeder Reactor was a daring innovation in many ways - it was the first high-power reactor to operate with touchy fast neutrons instead of the more tractable slow neutrons formerly employed, and it was the first reactor to be cooled by molten sodium. On December 20, 1951 the Experimental Breeder Reactor generated the world's first electric power from nuclear energy. Later, this reactor demonstrated that breeding with uranium was possible and thus established that abundant and cheap uranium-238 could be used as well as scarce and costly uranium-235 for the production of power. For the first time, man was assured of a practically unlimited source of energy.

The Experimental Boiling Water Reactor has proved beyond all doubt that steam can be generated in a nuclear reactor and used to drive a turbine with complete safety. Many commercial power stations modeled on this reactor are now being built. To find the conditions under which boiling could be safely permitted to occur, Zinn conducted in the Idaho desert the first of the celebrated Borax experiments, in which a reactor was deliberately made more and more supercritical, until finally, in a dramatic and informative test, the reactor was permitted to destroy itself.

In these numerous, vital reactor projects, Zinn was far more than the director of the enterprise. He supplied insight and judgment during the engineering design stage and took his turn at the control console during operation. He combines those qualities of leadership, scientific acumen and engineering skill which are essential in reactor development.

When the success of the Hanford reactors was assured, Wigner and Weinberg moved to Oak Ridge, where Wigner was named Technical Director of the Clinton Laboratory, later to become the Oak Ridge National Laboratory. These men recognized the importance of directing the knowledge of nuclear reactors gained during the war into normal civilian channels where it could be used in developing reactors for peaceful purposes. They organized the Oak Ridge School of Reactor Technology and helped found what Weinberg has called the "scholarly tradition in nuclear energy development". They performed a notable service to their scientific and engineering colleagues by presenting the results of their years of collaboration in the book THE PHYSICAL THEORY OF NEUTRON CHAIN REACTORS.

Wigner and Weinberg conceived the Materials Testing Reactor, the first of the high-flux reactors so useful in testing the effect of intense radiation on nuclear fuels and other reactor components. The plate-type, aluminum-uranium sandwich fuel elements which Wigner devised for this reactor are now being used in research and test reactors all over the world. After the new laboratory was well launched, Wigner returned to Princeton.

In 1955 Weinberg became Director of the Laboratory, where his leadership, enthusiasm and mastery of the reactor art have made the Oak Ridge National Laboratory one of the world's leading centers of reactor development. He has made the Laboratory pre-eminent in the development of fluid-fuel reactors and has conducted important experiments on the molten salt reactor and the aqueous homogeneous reactor. The fluid fuel used in these advanced reactor concepts can be charged, discharged or freed of fission products much more readily and economically than can the solid fuel used in other reactors.

I am sure that the four men being honored today would wish me to cite also the vital contributions to the development of nuclear reactors made by their scientific and engineering colleagues, far too numerous for individual mention here. The successful development of nuclear reactors has required the dedicated collaboration of workers from all over the world. But this occasion would not be complete without our paying tribute to Enrico Fermi, whose untimely death deprived the world of one of its greatest scientists. The "Italian Navigator" has left the stamp of his genius on all aspects of nuclear reactors.

Today, the technical feasibility of nuclear reactors has been established, in large measure through the efforts of these men. The main types of reactors have been devised and the principles of reactor engineering are well understood. Yet the full benefits of nuclear reactors are not yet being realized, because of the rather high cost of producing power and radioisotopes in them. I firmly believe that this delay in achieving the full potential of nuclear reactors is a temporary one, which will yield to further application of the qualities of theoretical insight, experimental skill, practical ingenuity and organizing ability, which served Szilard, Wigner, Zinn and Weinberg so well in bringing reactors to their present state of technical perfection. The world is fortunate that these men continue to devote their talents to the improvement of reactors. Under these circumstances, the day cannot be far off when nuclear reactors will make their full contribution to the welfare of mankind.

ATOMS FOR PEACE AWARDS, INC.

A MEMORIAL TO
HENRY FORD AND EDSEL FORD

77 Massachusetts Avenue, Cambridge 39, Massachusetts
Office of the Executive Secretary: University 4-9870

FOR RELEASE AFTER DELIVERY
4:00 P.M., WEDNESDAY, MAY 18, 1960

Text of an Address by

ISIDOR I. RABI

Professor of Physics

Columbia University

PRESENTATION OF THE ATOMS FOR PEACE AWARDS

to

LEO SZILARD and EUGENE P. WIGNER

ALVIN M. WEINBERG and WALTER H. ZINN

The National Academy of Sciences

Washington, D. C.

Wednesday, May 18, 1960

3:00 p.m.

"SCIENCE AND PUBLIC POLICY"

Dr. Killian, Dr. Szilard, Dr. Wigner, Dr. Zinn, Dr. Weinberg, honored guests, ladies and gentlemen:

Today there are being presented the 1959 and 1960 Atoms for Peace Awards. These awards are the third and fourth Atoms for Peace awards and the first to be given to residents of the United States for scientific contributions made chiefly in the United States.

Since we are, so to speak, in the family, I need not dwell on the obvious merits and distinctions of these four men. I count each of them as a personal friend of 30 years' standing or more, except for Dr. Weinberg, who arrived on the scientific scene only a little more than 20 years ago. Dr. Zinn was actually a student in my graduate courses at Columbia University.

I wish now to extend to them my heartiest congratulations and to express my pleasure at the honor of being invited to make an address on this occasion when members of our intimate circle are being honored so greatly and so significantly.

The Atoms for Peace award is a very special kind of award. Its very title suggests the profound perplexities of the postwar years. Combining the words "atoms" and "peace" combines science and politics, or science and statesmanship. The atom as such is neutral to human conduct or emotion. Peace was a goal dear to the human heart long before mankind had the knowledge to imagine such a thing as an atom. The conjunction of peace, the great hope of men in all nations, and the atom, the epitome of the advance of the knowledge of nature, is the mark of our time.

The Ford family, the founders of this award, had the dream of drawing the attention of the world to the possibilities of utilizing the great discoveries and applications of science, nuclear science in particular, to forward the cause of peace rather than war. The intention was noble and statesmanlike and expressive of the time at which the award was first announced, the time of the first Geneva International Conference on the Peaceful uses of Atomic Energy in 1955. That conference in itself was a blend of science and statesmanship such as had never been seen before.

The intervening five years have shown that science and peace do have a connection, not yet as great as science and war but certainly not negligible. The 1955 Conference on the Peaceful Uses of Atomic Energy marked the first massive confrontation of scientists from the Soviet bloc with the colleagues from the West. It opened an era of good feeling of mutual understanding and respect between these two groups of scientists which has increased in time as more Americans have had the opportunity of visiting Russian installations and vice versa. This year, according to Professor Emilyanov, the Russians plan to send 40 scientists to the Rochester Conference on high energy physics. Last year we sent 60 to the Kiev Conference in the same field.

These contacts between scientists have led to an important amount of declassification of scientific and technical information. This declassification has not only enlarged the area of fruitful exchange of information with the East and with our own allies, but has also accelerated our own program because it made possible a freer flow of information.

Indeed one can say that science has provided an important bridge between the two rival blocs and a means for further peaceful cooperation for the lessening of tension and suspicion. Most scientists in the United States and in allied countries have regarded these advances toward a more open world as favorable omens for a future where the shadow of destructive warfare will hang less heavily over mankind. Most scientists have held this view, but not all.

A minority regards any lessening of tension as a prelude to a diminution of our effort in the development of atomic weapons and their means of delivery. In their view, safety can be achieved only by the development of atomic weapons to a degree which demands the utmost stretch of the imagination and by the most devoted effort. In this view no means are too large to apply to this end. They lay their hopes for peace paradoxically enough in a mutuality of terror which they feel would immobilize all aggressive impulses in the nations of the world. While the large nations are being held back from attacking one another by the certainty of annihilating retaliation, limited warfare according to this view could go on quite in the classical pattern without a great deal of disturbance. With sufficient effort, "atomically" advanced nations would in time possess stores of atomic weapons so cheap and so plentiful that they could overcome the resistance of less advanced nations with the same ease with which the Spaniards conquered Peru.

My pictures may be sharply drawn but no one who has followed the discussions will suggest that the positions taken by the two sides are caricatured beyond recognition. Granted that my description has some relation to reality we ask ourselves what is the course of wisdom in the midst of these divided counsels. How should the atom and peace be conjoined so that our young people may see a future before them where, at the end of the rainbow, there awaits something more pleasant than a huge super nuclear explosion.

The solution to the dread problems posed by the advances of science and technology can certainly not be found by the scientists alone. Just as certainly these problems can not be solved by men who have little or no knowledge of science or technology however great the responsibility which has been thrust on them either by election or by appointment. Even a combination of the best brains in our country from all fields of experience (science, business, religious and ethical as well as the academic and political) is hardly equal to the task of mapping a wise and safe course through the tangle of mistrust and terror which has grown up in the postwar years.

We must find a way through this thicket of charge and countercharge where reason and common sense can prevail in the end.

The history of the efforts to prevent a runaway catastrophe in the use of atomic weapons begins back in 1946 with the Acheson-Lilienthal report. It goes on to the Baruch proposals, later modified to be the United Nations proposal for the control of atomic energy. When these measures failed there was a quiescent period in which the Soviets acquired the atomic bomb which was followed by the U.S. thermonuclear bomb and again by the Soviet thermonuclear weapon.

In 1955, during the Geneva Conference on the Peaceful Uses of Atomic Energy I was asked to represent the U.S. in a discussion with the Soviet representative on the question of safeguards which might be devised so that the spread of the peaceful uses of atomic energy would not be a danger to peace through the diversion of bomb material. Dr. Wigner and Dr. Zinn were together with me in this enterprise. The discussions hinged on the existence of an agency to be formed as suggested by President Eisenhower. This agency, the International Atomic Energy Agency, is now in existence but the dangers to the peace have not diminished and as to be expected our meeting ended in a moral victory for us but actually in failure.

It is customary to lay the blame for the failure of these and subsequent attempts on the backs of the Russians. And indeed I would be among the last to deprive them of their proper share of the blame, which is large. But we too are not blameless. Although we can not do much about reforming the Russians, we ought to be able to take steps to set our own house in order.

Those of us who travel abroad and have the problem of representing the United States in one way or another are often taken aback at the degree and intensity of criticism which is directed both at our actions and at the statements of some of our political figures. No such intense criticism is directed at the Soviet Union for acts compared with which our own slips would seem to be minor. At first sight this criticism which holds us to a stricter accounting seems unfair. However if one probes more deeply this attitude is quite natural.

We must understand that we occupy an entirely different position in the world from the Russians. The United States is indeed the leader not only of the Western world but to an extent greater than we realize the United States is the leader of the whole world. Beneath the scoffing, mocking, and hostility of the Communist world there is nevertheless a deep respect. America is the ideal not only materially but in most elements of existence which human beings share in common. If America were to disappear there would be no embodiment of the the Russian goal, no one to catch up with and surpass. For these reasons, when we fall short of the high standards which we and the world have set for us the failure is felt very deeply. The elevated and rarefied moral atmosphere in which we are supposed to live may be a bit hard on us plain folks here at home but it is the role which we have assumed and the role which we have to play.

If one can be certain of anything in the uncertain course of events in this decade, the moment the United States stops supplying leadership the world as we know it will disintegrate and fragment into chaos with no one but the Russians to pick up the pieces. We therefore have a moral obligation to be wise in order to guide ourselves and others, and to be prosperous so that we can spare from our own supplies to help others. We seem to have found a way to be prosperous and now we ask ourselves, how can we cultivate wisdom in policy and action, especially in the field of atomic energy for war and peace, which is so central to all our problems.

As I review in my mind the 15 years which have passed since the end of the war I am forced to the conclusion that very many of our difficulties stem from one fundamental distortion of our natural habit: the distortion caused by the exaggerated secrecy in the military field and in the atomic field especially. You will all agree that these fields are central to our problems of foreign and domestic policy but you may well ask why I regard secrecy which seems so necessary to be at the same time so very damaging.

The answer lies in our history and our tradition. We are a pluralistic society dedicated to a distribution both of authority and responsibility. From the President of the United States on down we have been against concentration of power here in Washington. The pressure of events has compelled a greater and greater concentration of such powers, but they have been granted most grudgingly. To some, the weakness of our central government is a source of regret, but there is no doubt as to the general public feeling. Washington is and always has been suspect.

Although the Constitution vests control of foreign policy firmly in the hands of the President, in actual fact the President does not operate in a vacuum. He must share his responsibilities with the Senate and with the House of Representatives. Agencies of the government in addition to the Department of State are directly concerned; the Department of Defense, the Atomic Energy Commission are only the most important. Beyond these there are other agencies but almost as important are the press, the daily, weekly, and monthly periodicals, TV and radio. Behind these are the opinion makers in the universities, the labor unions, in large and small business and of newer importance the scientists and experts of every variety.

Policy comes out as a harmony produced by all these interacting forces. This has been the American tradition and practice. Now what happens when secrecy intervenes? Pathetic and profound ignorance of the facts does not prevent the policy makers inside and outside of government from carrying on in the field of atomic energy as if all were clear to them. They gather a rumor here, a leak there, and off they go. Ignorant or learned, they take a stand and public opinion is formed.

Our government can not act strongly without ample support from public opinion. For wise action an informed public opinion is necessary. When secrecy intervenes, an informed public opinion can hardly exist. Too often we have instead a manipulated public opinion formed by leaks, half truths, innuendoes and sometimes by outright distortion of the actual facts.

We can now ask ourselves, what have we really gained from our exaggerated secrecy in the way of real security? Actually very little. The Russians are not far behind us in atomic weapons but our allies have been left way behind after expending an enormous treasure in trying to rediscover facts and techniques already known to the Russians as well as to ourselves. The secrets of military technology must be as highly protected as any trade secrets but only as long as they are real secrets. In most cases this time is measured in years rather than decades. Although most policy makers, amateur or professional, are not deeply interested or capable of judging the technological situation, secrecy results in frustration, doubt and timidity about the exercise of any independent judgment. The result has been that a number of less inhibited men of greater or lesser scientific or technical accomplishment but with a low boiling point have been gaining the public ear on the basis of prestige acquired through a technical accomplishment, quite limited in scope. Their policy statements are given weight on the basis of skills not necessarily relevant to the dread subjects of war and peace which they discuss with easy confidence. Were it not for the mantle of secrecy which surrounds the hard core of the matter, the intelligent public would be quite capable of judging the questions under discussion. The fear of being guilty of a judgment based on a partial knowledge of the facts misleads many judicious people into accepting judgments by others whose knowledge is often even more partial but which extends into the dread domain of the top secret.

The questions which should concern the informed nontechnical general opinion are rather such as how many weapons do we actually have, what are their means of delivery, what are the effects of these weapons, what is the composition of the stockpile in the range of yields and sizes, how much do they cost, who controls them and by what means are they controlled. What are claimed to be the further needs for nuclear and other weapons and what is the justification? What do we know about the state of the art in other countries?

The answer to every one of the questions falls under a high degree of classification. Some of them have this classification for very good reasons and others merely from force of habit. One can nevertheless ask how can the publisher, the editor, commentator or editorial writer of an important organ influential in informing and shaping public opinion carry on in an intelligent way without a fairly full knowledge of these and other facts.

We are now engaged in tripartite negotiations with the Soviets and the United Kingdom on a test suspension coupled with a system of inspection. Clearly, this is a most delicate matter perhaps best left to the wisdom of the President and his most trusted advisers. It is his job and his duty as set forth in the Constitution. Nevertheless, it has not been left to the President, and public debate, which impairs the freedom of action of the President, rages over the land. This would be just the right thing if the debate were well informed. We were not brought up as a nation to believe that father knows best. Unfortunately the debate is not well informed and becomes more of a conflict of pressure groups rather than a quest for clarity and wisdom.

I hope I have made my point that to live at peace with the atom we must find our way back to the fundamental principles on which this republic was founded. We must again become a nation of free men informed by a free press. Since the very beginning we have been told that this is a dangerous doctrine. In about a century and three quarters of national existence we have learned to live dangerously in a dynamic society. Totalitarian countries preserve their secrecy by regimenting their people, giving them neither freedom of travel, freedom of the press, freedom of conscience or freedom of opinion. Some may envy their secrecy but no one will envy their lives.

In closing I again wish to congratulate the four recipients of the Atoms for Peace Awards. They are the symbols today of the vision of President Eisenhower and of the Ford family who embodied this vision in the substantial form of these awards. We hope that this vision will remain bright as it must because it is a vision of sanity, of reason, of justice, and most of all it is a vision of peace and cooperation among men.

ATOMS FOR PEACE AWARDS, INC.

A MEMORIAL TO
HENRY FORD AND EDSEL FORD

77 Massachusetts Avenue, Cambridge 39, Massachusetts
Office of the Executive Secretary: University 4-9870

FOR RELEASE AFTER DELIVERY
4:00 P.M., WEDNESDAY, MAY 18, 1960

Remarks by

DR. LEO SZILARD

in response to

THE ATOMS FOR PEACE AWARD CITATION

The National Academy of Sciences

Washington, D.C.

Wednesday, May 18, 1960

3:00 p.m.

(WITH BIOGRAPHICAL NOTE)

Mr. Chairman, Honored Trustees.

In 1913, one year before the first World War, H.G. Wells published a book entitled "The World Set Free" in which he predicts the discovery of artificial radioactivity and puts it into the year of 1933, the year in which it actually happened. In this book Wells describes how this discovery is followed by the release of atomic energy on an industrial scale, the development of the atomic bomb and a world war which is fought with such bombs. London, Paris, Chicago and many other cities are destroyed in this war, which Wells puts into the year of 1956. I read this book in 1932, before I myself had done any work in the field of nuclear physics.

In 1933, I went to live in London. In the fall of that year, the London papers reported a speech given by Lord Rutherford at a meeting of the British Association, in which he said that whoever talked of the release of atomic energy on an industrial scale was talking moonshine. I was pondering about this while strolling through the streets of London. On that occasion, it occured to me that Rutherford might be wrong, because there might exist an instable element that splits off neutrons when bombarded by neutrons and such an element could sustain a nuclear chain reaction. On the basis of the published masses of helium and beryllium, the beryllium nucleus should have been instable and it could have disintegrated into two alpha particles and one neutron, when hit by a neutron.

At this time, I was playing with the idea of shifting to biology. But the possibilities opened up by these thoughts were so intriguing that I moved into nuclear physics instead.

In the summer of 1934, T. A. Chalmers and I looked into the mystery of beryllium and we found that beryllium emits neutrons when exposed to the gamma rays of radium. Other experiments showed, however, that gamma rays of lower energy were incapable of splitting beryllium and this made it appear doubtful that beryllium could sustain a nuclear chain reaction.

Nevertheless, the thought that some element or other might be capable of sustaining such a chain reaction stayed with me and I pursued it from time to time without success until I finally gave up hope in the fall of 1938. In December of 1938, I so advised the British Admiralty, to whom I had previously assigned a secret British patent which described the general laws governing nuclear chain reactions. One month later, I visited Wigner, who was ill with jaundice in Princeton. On that occasion I learned from him that Hahn and Strassman had found that the uranium nucleus breaks into two heavy fragments when it absorbs a neutron. To me, it appeared at once very likely that these fragments would evaporate neutrons and this meant that uranium might sustain a chain reaction. "H. G. Wells, here we come!" - I said to myself. Neither Wigner nor I had much doubt at that time that we were on the threshold of a World War. Finding out whether neutrons are emitted in the fission of uranium appeared to us, therefore, as a matter of great urgency.

The rest is history.

In 1945, as the war drew to its end, one of the younger staff members came into my office at the Uranium Project at the University of Chicago and said that he felt it was a mistake that so much emphasis was placed on the bomb and that we were not paying sufficient attention to the peacetime applications of atomic energy. "What particular peacetime applications do you have in mind?" I asked him, and he said, "The driving of battleships."

I often told this story after the war as a joke. These days, when we are rapidly moving towards the so-called atomic stalemate, it seems to me that the story is even better, because it now represents two jokes rather than just one.

It is not always easy to say what is or is not a peacetime application of atomic energy, but if the large-scale liberation of atomic energy which we have achieved abolishes war, as it well may, the distinction will cease to be important. If war is to be abolished, the nations of the world must either enter into a formal agreement to get rid of the bomb or they must reach a meeting of the minds on how to live with the bomb. So far, we have not made much progress in either direction. It seems likely, however, that, as far as America is concerned, she will be forced to decide in favor of one or the other of these two alternatives during the term of office of the next President, and either decision might be better than no decision.

BIOGRAPHICAL NOTE: Leo Szilard was born in Budapest, Hungary on February 11, 1898. After studies at the Budapest Institute of Technology, he earned a Dr. Phil. degree at the University of Berlin (Germany) in 1922. He held various academic posts in Germany and England before coming to the United States in 1937. He was an active developer of radiation chemistry--the use of radioactive elements to influence the course of chemical reactions. He taught and conducted research in nuclear reactions at Columbia University, publishing papers in collaboration with the late Enrico Fermi and Walter Zinn among others. He was an early proponent of large scale research, sponsored by the government, into the possibility of nuclear chain reactions and, with Eugene Wigner, composed the famous letter to Franklin D. Roosevelt from Albert Einstein which was instrumental in establishing the "Uranium" project. His participation in the work of this project at Columbia and at the University of Chicago from 1938 to 1946 resulted in his being granted (with Fermi) the first U.S. patent on nuclear chain reactions. Since 1946 he has been Professor of Bio-Physics at Chicago and has made important contributions to the control of the culture of micro-organisms (with Aaron Novick), which in turn have led to significant discoveries in the field of genetics. Professor Szilard is a Fellow of the American Physical Society. In 1951, he was married to Dr. Gertrud Weiss, who is a member of the faculty of the University of Denver.

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THE ATOMS FOR PEACE AWARD CITATION

for

EUGENE PAUL WIGNER

By bringing to the early work on nuclear chain reactions and on nuclear reactors your wide knowledge of engineering and chemistry in addition to your theoretical and experimental skill in the physics of the atom, you contributed greatly to that combined effort of men of many disciplines which has given us the practical gifts of the atomis power.

By joining with other scientists of vision in the time of danger, you contributed greatly to the implementation of the research and development which led directly to the first controlled nuclear chain reaction.

By maintaining a lively interest in the potential of atomic power and concern for its best use for the good of all men, you have served to encourage new and serious evaluations of the place of science and technology in the modern world.

By teaching and by directing important research projects, you have contributed to our understanding of nature and to our ability to use nature for the imporvement of man's physical environment thus augmenting man's dignity by augmenting his understanding.

May the Atoms for Peace Award signify to you the recognition by men and women throughout the world of your contributions "for the benefit of mankind".

# # # #

ATOMS FOR PEACE AWARDS, INC.

A MEMORIAL TO
HENRY FORD AND EDSEL FORD

77 Massachusetts Avenue, Cambridge 39, Massachusetts
Office of the Executive Secretary: University 4-9870

FOR RELEASE AFTER DELIVERY
4:00 P.M. WEDNESDAY, MAY 18, 1960

THE ATOMS FOR PEACE AWARD CITATION

for

ALVIN MARTIN WEINBERG

For your sustained contributions to the development of nuclear reactors, beginning with your participation in the early work at Chicago and still continuing productively;

For your contributions to the understanding of the theoretical problems posed in the study of the nucleus;

For your leadership in the development of experimental reactors and their evaluation;

For your guidance and counsel to workers in the field of nuclear energy and for your constructive contributions to the formulation of national scientific policies bearing upon the peaceful uses of atomic energy;

This Atoms for Peace Award is given. May it signify to all people the recognition of the importance of your work "for the benefit of mankind".

# # # #

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4:00 P.M., WEDNESDAY, MAY 18, 1960

Remarks by

ALVIN MARTIN WEINBERG

in response to

ATOMS FOR PEACE AWARD CITATION

The National Academy of Sciences

Washington, D.C.

Wednesday, May 18, 1960

3:00 p.m.

(WITH BIOGRAPHICAL NOTE)

It is with a deep sense of gratitude, not to say awe, that I accept this great honor. Because of my relative youth I am the first recipient of this award whose scientific life has coincided with the post-fission era, and who has devoted practically his whole career to the exploitation of Hahn and Strassman's discovery. As such I am perhaps more aware than most of the full extent to which large-scale development of nuclear reactors is a group effort, and how small can be the contribution of any single individual. In accepting this award I can therefore do, at best, inadequate justice to the many scientists and engineers who are my colleagues at the Oak Ridge National Laboratory, and whose dedication, ingenuity, and faith are really being honored here.

I must also mention the extraordinary debt which I owe to my close friend and teacher, Eugene P. Wigner. Much of what we at Oak Ridge have been trying to do in our heavy nuclear development over the years is built upon a tradition of scholarship and of pointed practicality which we have learned from our former Research Director, Professor Wigner.

Although the work of developing an ultimate, permanent, and economical energy source based on fission is still unfinished, we are beginning to see ways of achieving this crucially important technological goal. Should we succeed in our efforts, it will be the great good fortune of our scientific generation to be able to give to posterity an adequate and permanent supply of the most fundamental raw material energy. That a world no longer beset by fears of energy shortages will inevitably be a more stable and peaceful world, we who work on nuclear energy development deeply believe. It is this vision of an abundant and peaceful world which inspired the efforts of the men to whom the award is dedicated; it is toward the achievement of this vision that the Atoms for Peace Award will continue to inspire reactor technologists everywhere.

BIOGRAPHICAL NOTE: Alvin Martin Weinberg was born in Chicago, Illinois on April 20, 1915. His collegiate education was at the University of Chicago, where he completed work for the Ph. D. degree in 1939. He continued teaching there in the Department of Physics until 1941, when he joined the Metallurgical Laboratory organized at Chicago to develop controlled nuclear chain reactions. He was associated with this group until 1945 when he transferred to the Oak Ridge National Laboratory, Oak Ridge, Tennessee where he has been, successively, Section Chief, Director of the Physics Division, Research Director, and Director, having held the directorship since 1945. He is co-author, with Eugene P. Wigner, of "The Physical Theory of Neutron Chain Reactors". He is a member of the American Physical Society, the Scientific Research Society of America, and the American Nuclear Society of which he was president in 1955. He is married and has two sons.

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THE ATOMS FOR PEACE AWARD CITATION

for

WALTER HENRY ZINN

In the development of nuclear chain reactions from a theoretical concept to the threshold of the wide spread use of nuclear reactors for research and for power, your contributions have been many.

With Leo Szilard, you observed the release of neutrons during the fission of uranium, an observation sought and obtained by others at the same time. This observation demonstrated the possibility of the chain reaction which is the basis of the reactors.

You participated in the experiment which resulted in the first controlled nuclear chain reaction.

You have been a leader in the design, construction, and evaluation of experimental reactors which have supplied improved methods and essential data for the world-wide utilization of atomic energy through the medium of power generation, research facilities, and isotope production.

May the Atoms for Peace Award signify to you the awareness of people throughout the world of the importance of the contributions you have made "for the benefit of mankind".

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(WITH BIOGRAPHICAL NOTE)

Seventeen years have passed since the research work of many scientists over many years culminated in an experiment in which, for the first time, man secured control over the release of the vast energy of the atom. At that time, the possible beneficial uses of this new form of energy were the subject of very considerable discussion and speculation.

The general opinion of the individuals directly associated with the experiment was that the important applications would be as a source of radiation for research in the physical and medical sciences and as a new source of energy for electricity generation.

None of us foresaw the extent to which establishments for research in the wholly peaceful applications of atomic energy would be created as a result of the impact of atomic energy on the minds and imaginations of people everywhere. The scientific results already obtained in these establishments by using research reactors and radioactive materials are indeed impressive, and I suppose we see only the very beginning of this work. Perhaps still more important is the fact that these atomic energy establishments are serving as centers to which scientists from many countries travel to make use of unique facilities, thus re-establishing the atmosphere of free association and collaboration which is fundamental to the spirit of science.

Substantial progress has been made in the application of the nuclear reactor to electrical power generation, and large nuclear power plants are in operation in a number of countries. No one can say just when nuclear energy will produce the abundant and inexpensive electrical power it inherently promises, but the world-wide concerted attack on this difficult technological problem suggests that success will be achieved, and in ample time to replace our diminishing fuel resources.

I have had the opportunity to see firsthand the rapid evolution of diverse and complicated machines from that early pile of graphite and uranium building blocks. Formidable technical problems which in earlier times would have taken decades to solve have yielded quickly to the power of the modern research laboratory complex. One can only express regret that the political problems created by atomic energy have not, as yet, been solved. We must all join in the hope that the United Nations, in time, will develop the strength, based on world-wide cooperation, to deal with political problems with the same speed and competence we expect from our laboratories in solving physical problems.

An extensive new technology and industry have developed from the first efforts to make a nuclear chain reaction. It has required the dedicated work of many talented scientists and engineers, and I wish to acknowledge the great privilege which has been mine to have worked so closely with so many of them.

I am deeply grateful, Mr. President and Trustees, in being named co-recipient of the Atoms for Peace Award. I am greatly honored that the Award commemorates the memory of Henry and Edsel Ford whose vision and pioneer work have contributed so much to the development of our modern industrial society. I have high hopes that atoms for peace will similarly enrich the life of man.

BIOGRAPHICAL NOTE: Walter Henry Zinn was born in Kitchener, Ontario on December 10, 1906. He earned his B.A. degree at Queen's University and taught there in 1928. He came to the United States in 1930 to teach and to study at Columbia University, where he earned his Ph.D. in 1934. He was a member of the faculty of the City College of New York from 1932-1941, while carrying on research at Columbia, working with Leo Szilard. Dr. Zinn and Dr. Szilard published a short paper in 1939 which reported experiments demonstrating the possibility of nuclear chain reactions.

He joined his Columbia colleagues at the Metallurgical Laboratory in Chicago in 1942, where he was a member on the team led by Enrico Fermi which constituted the first successful atomic pile. In 1946 he became director of the Argonne National Laboratory in Lemont, Illinois and there led work in the development of the heavy-water, pressurized water, and fast breeder reactors. In 1956, he resigned his position to become president of the General Nuclear Engineering Corporation. In 1959, he joined Combustion Engineering, Inc. as Vice President. He is married and has two sons. He became a citizen of the United States in 1938. He is a member of the American Physical Society, American Institute of Chemical Engineers, American Nuclear Society (its President in 1955). He is author of numerous papers in theoretical physics and nuclear reactor problems.