

August 10, 1967

Dear Julius:

First let me congratulate you on the accomplishment of the forthcoming book and on a gratifying response from an important quarter.

Under pressures, I have only been able to leaf through the advance sheets delivered late yesterday afternoon by Lippincott, but having discovered an at once false and ridiculous statement on page 87, it is absolutely essential that you correct it. For, apart from the mis-statement, reviewers are apt to catch it and exploit it against you. That epilogue by President Bolling of Earlham College stemmed from conversations with you and from drafts that came within the knowledge of yourself and your assistants for the production and publication. Not only have I not made a statement such as appears in the middle of page 87 but literally nothing in all that has appeared by journalists and publicists could be warrant for the allegation that Einstein was "brought together" with "President Roosevelt." While journalism, with its penchant for treating emergent history like a scenario of a play has magnified the Einstein letter, it was an historical fact but part of a large dossier of material which was left merely for the record.

The labor of conversion of the President to the Atomic Project was carried out by me from the early months of 1939, when through my contacts with the Institute of Advanced Study at Princeton I learned through my discussions of the success of Atomic Fission in the course of Niels Bohr's Princeton visit. As any kind of a summary of this complex historical eventuation must fall short of adequacy, and that applies to what will follow, let me rush to indicate for you and for your publishers the required correct statement in place of the total fictional one that appears on page 87. Incidentally, that sentence in mid-87 also suffers from absurd chronology, namely the date of a first communication from you "at the time of Pearl Harbor" and the imputed link of that with the origination of the Atomic Project as a quest by me ever since the effectuation by Drs. Hahn and Strassmann of Atomic Fission as reported at the very beginning of 1939. Now, to replace a hitherto unheard of fictional statement regarding myself, President Roosevelt and Dr. Einstein, will only require conforming to the article that was published in the March 14, 1950 issue of Look by N.S. Finney. On page two of the enclosed reprint he states that he had "examined" records of conversations, and copies of the memoranda used as the basis of discussions with President Roosevelt (page two at foot of column one of the reprint). Now with regard to my presentation, the relevant summary paragraph is in the closing one of column three, page three as follows:

"On October 11, 1939, Dr. Sachs read a long letter-memorandum of his own to President Roosevelt along

with the letter signed by Dr. Einstein and a joint memorandum signed by Dr. Szilard and himself. The President was impressed and willing to help, but not convinced he should embark on such a costly course of action under government auspices. (Dr. Sachs later advised him that producing an atomic weapon might well cost two billion dollars on the basis of the telescoped cost of electrical power in the generation before World War I.) Dr. Sachs says he asked President Roosevelt if he could see him the next day. The President invited him to come to breakfast."

It is essential that the mixed-up sentence on page 87 be removed and that the description of my role in the Atomic Project be made to stand on its own and to harmonize with the facts that Dr. Einstein's participation was through (a) inclusion in the dossier and (b) through other letters in my correspondence with him as set forth in the latter part of the record of my testimony to be summarized from here on.

Anticipating that ensuing summary let me provide a reinforcement for the above in the Look article by means of the attached reproduction of page ten of a very recently issued book on the "Manhattan Project" at the beginning of this year, 1967. The opening chapter called "The Untold Story of the Making of the Atomic Bomb" declares regarding myself that "for several months" prior to the approach by the refugee physicists I had "tried to convey to Roosevelt the possibility of developing a nuclear weapon." The pivotal paragraph on that page ten is as follows:

"When the letter signed by Einstein was personally delivered to the White House by Sachs on October 11, 1939, the President, although he understood little of uranium fission, was already prepared by Sachs and was receptive to the idea of nuclear danger. He was impressed by the Einstein letter detailing the likelihood that Germany would try to develop an atomic bomb that would certainly lead to world conquest. He decided immediately to create a committee that would give Government financial assistance to American universities engaged in uranium research."

("Manhattan Project" by Stephane Groueff - Little, Brown and Company, 1967)

* * *

We can now turn to what underlies the masses of journalistic and publicistic publications on the Project. While in their efforts to dramatize as well as to simplify, a sort of mythology has accrued to the letter, not one of the publications has conjured up that new myth in your book that I "brought together Einstein and President Roosevelt." The President didn't seek it nor did Einstein. The linkage with it was as a symbol for the refugee scientists who, like myself, dreaded the possibility of an

eventual discovery and technology of an atomic bomb. In 1939 the possibility of "chain reaction" or the indispensable prerequisite for any weapon was regarded by most scientists as highly improbable. Indeed, the famous Professor Fermi did not demonstrate a "chain reaction" until a year after Pearl Harbor. Moreover, the Atomic Project, as a definitive undertaking by our Government, had to overcome uncertainties and improbabilities of being cast into the limbo over the whole long time tract from the beginning of 1939 - when I had first acquainted President Roosevelt with the significance of Atomic Fission - to the autumn of 1941. That will be presented by me as one of the guests of the University of Chicago at the Fermi Celebration in December this year, 1957, or the Twenty-fifth Anniversary Observance of the first controlled release of nuclear energy. From that autumn of 1941 to December 1942 the decisive novel experimentation had been progressing under the leadership of Dr. Fermi. It had been he, who in March 1939 had apprised Adm. Hooper of Atomic Fission and of the work by experimentalists at Columbia, inclusive of Dr. Szilard, yet had expressed his view that the prospects of "chain reaction" were, in his judgment, a "chimera." - But what had impelled me from the very start of those lectures at Cambridge University described in my testimony and the refugee scientists in the sequel to the labors on fission by the German scientists and by Dr. Meitner - what impelled all of us was a political concern that Nazi Germany must not get the jump on us!

Turn at last then to the first and basic document, my testimony before the Senate Committee on Atomic Energy in November 1945 on the origination of the Atomic Project, which showed that advance presentations were made by me to the President in the immediate wake of the effectuation of Atomic Fission at the end of 1938, with publication in the German scientific journal and in the world wide influential British scientific journal Nature, early in 1939. The inevitability of war was forecast by me for President Roosevelt in the beginning of March 1939, or ahead of the Nazi seizure of Prague in the middle of that month. This was part and symbol of what I had called "onrushing dangers" in the memorandum brought to the attention of the President on "imminent world war..." Furthermore, I had declared that U.S. was exceptionally placed "to use the time drafts that can still be made on the 'bank of history' for the preparedness that has become more and more urgent ... in the course of the prospective unfolding aggression of Nazi Germany." In that perspective I described the epoch in scientific discovery of Atomic Fission, news of which was brought to the U.S. at the very beginning of 1939 by Dr. Niels Bohr (condensation of page 555 of my reprinted testimony on "Background and Early History Atomic Bomb Project in Relation to President Roosevelt.")

Sincerely yours,

Mr. Julius Stulman
World Institute Inc.
777 United Nations Plaza
New York, N.Y. 10017



Subj.
[Atomic]
n.d.
post 1966

CHAPTER I.

ON CONTEMPORARY HISTORY'S MOST COMPLEX EVENTUATION VS. REPORTORIAL REDUCTION TO DE-CONTEXTED INSTANTIZED EVENTS

When first disclosed in August 1945, six years after inception, the Atomic Project was cast by the news media in their scenario-mode of personalized drama as a joint recommendation to the President from a world-renowned scientist and Presidential advisor that came to be implemented and was climaxed by an unprecedented weapon performance. That mode and model have perdured since and have constricted publicists and even contemporary historians to treat the instantized presentation to the President as the genesis of the Project and its subsequent unfolding as controlled by technical details. The extraordinary paradox about that treatment is that whereas the new concept of the atom in the wake of Lord Rutherford's discoveries, as crystallized by the time of the outbreak of the Great War in 1914, was on the model of a solar system, though inconceivably small, the interested general and even scientific publics have been induced to acquiesce in the notion of an initiatory event uprooted from the confluences of complex contexts, and ^{of} subsequent accruals as pointillist instantized other events within a self-contained reference-frame of just the scientific labors and the culminative military application. In respect to the at once most expansive exploration and time-telescoped achievements and utilization for victory in the most critical struggle of history, literally not a single large-scale effort has been made to see and describe the Project "steadily and whole."

A.

Accordingly, this venture by the initiatory proponent and sustained protagonist over the life of the Project - moved by entreaties to set the history straight - has been keyed into two commemorations by the University of Chicago as pivotal figure in the Project's ^{experimental} origination, in whose nearly contiguous

- 2 -

celebrations it has been his privilege to participate. The instant tuning-up for the Twenty-Fifth Anniversary Commemoration of the First Nuclear Chain Reaction at opening-December 1967 recaptures a note that was struck a year ago by the writer as speaker at the Seventy-Fifth Anniversary of the University of Chicago's founding. That note was that the Renaissance of Science in this century - matching the 17th century's role as the "Age of Genius" in Whitehead's term - had been proceeding up to World War II across converse rather than parallel developments in the western World as a system of power. After the victory in the Great War of 1914-18 by the Allies and the US, first the European members of the Coalition struggled with reconstruction through the Twenties, then the US joined in the common Great Depression, and then across the striven-for but unfulfilled recoveries of the Thirties these carriers of Western Civilization became characterized by declensions in military and political power and also prospects over against the resurgent European powers that had undergone defeat. The designated Great War, which was prosecuted as "the war to end war," was in the aftermath followed by disillusionment and self-distrust, that in turn, after the Great Depression, evolved into defeatism and appeasement.

That metamorphosis in internal and external power and psychological attitudes between primarily the European contestants in the Great War - as aggressors for hegemony subjected to defeat and as defenders that triumphed - became on the eve of the resumed war of aggression the complex political-cultural setting that, in the converse movement of science, brought forth the triumphant discovery of atomic fission. Yet the political and cultural reverses ahead for the victors were discerned in the very midst of the labors of the Versailles Peace Conference in late-spring 1919 by an outstanding European man-of-letters, Paul Valery, in this opening to his forebodings, entitled The Crisis of the Spirit:

"We later civilizations, we too now know that we are mortal ... And we know that the abyss of history is deep enough to hold us all ... The swaying of the ship has been so violent that the best-hung lamps have finally overturned ..." (Vol. X, p. 23, Bollingen Foundation's translation, 1962)

The extensive confirmations by events over the subsequent score years were interacted by the above alluded-to unparalleled efflorescence of physical science. And as scientific like other history does not write itself anonymously, but by historical agents that make the discoveries and are, in the writer's term, 'science-historifiers,' the very retroversion to counter-civilization by the defeated-become-aggressors produced a new human situation in science. It was in the midst of a world order being gradually hurled towards the brink of the abyss that great physical scientists from Central Europe became pilgrims from Continental Europe to Britain and to the New World. We had, then, by the prelude to World War II a conjuncture of three historical forces: (1) reversal in the World Balance of Power, (2) epochal Science-Progress, and (3) the oppression of Free Science and scientists by the racist cult of the aggressors and consequential exile of leading figures in that New Science.

Focusing on the closing member of the just defined triad of historical forces, the pattern of persecution and ensuing migration has, alas, been traced recurrently through history: In respect to the shifted loci of intellectual activity, notable exemplars were the sequels to (a) the Spanish Inquisition; (b) the French terror against the Huguenots at the end of the 16th century that compelled hosts, including Descartes and the parents of de'Moivre, to seek and find sanctuary in Holland and England and their colonies; and (c) even the milder discriminatory treatments by reactionary regimes that brought to the US shores a non-conformist entrepreneur like duPont prior to the French Revolution and later the German and other Continental Forty-Eighters. This historical

sidelight has merited recording for the responsive echo it received from President Roosevelt by virtue of his family's links with that type of migration. It needs to be added that once the President's mind was set vibrating within that 'resonance range,' - to borrow a term from nuclear physics - he, in his own turn as a judge of men and of history, was recurrently ready over the fluctuating vicissitudes of the Atomic Project to give a preferred line of credit to the optimistic attitude towards the basic issue of chain-reaction feasibility by the refugee-scientists over against the scientists of the American Establishment. This derivative sidelight will have to be invoked considerably later herein in the treatment of what we designate as "the protracted nascence of the Atomic Project" from 1939 through 1941.

B.

Not only do the already adumbrated diverse perspectives call for a very different portrayal than the conventionalized mode and mold for the Atomic Project's origination but, as will later be developed, the diverse perspectives were - from the outset to the definitive authorization by the President to Dr. Vannevar Bush towards the end of 1941 - operative together in differential ways that had to be harmonized, lest the difficulties of reaching a consensus on Tasks' Agenda might prevent its being carried out. It is that struggle between proposed programs from scientists with differing priorities that is very difficult to articulate within the established procedures of historians for history-presentation or historiography. The historian operates with history as a Past, a unidimensional order of sequences in (a) either linear progression or (b) curvilinear, inclusive of intersecting and tangential events. But with the kind of emergent history or, to use our term, historification that concerns us, the alternative forward-histories, or the varying appraisals by the experimenting

scientists and what for the enterprise was still more urgent, the top leadership with foresight and forethought had to be directed to choosing from alternatives that were forward vectors. That leadership had to be super-Columbuses by surpassing President Lowell's definition of Columbus, they had to know where they were going, and when they got there where they had been, and what they secured and what for they secured. In the setting then of this Celebration of the Twenty-Fifth Anniversary of the Nuclear Chain Reaction, it is meet that we do grateful honor to that band of leaders - from Bush to Conant to Compton, from Fermi to Oppie to Lawrence to Drey, from Groves as master coordinating engineer to heads and staffs of the industrial technical corporations that collaborated in the accelerative completion of the Project. And alongside of assemblage of scientific inventiveness it is meet that we pause and do grateful honor to the corresponding large British group of profound thinkers and technical innovators, who as recurrently noted herein were avant-garde in their confidence and stimulators who by their practical suggestiveness inspired and aided our scientific leaders and executants.

As for the experimentally decisive turn, it is fitting on this occasion to register the verdict from the present Chief Scientific Advisor to the British Government that "the achievement of a Nuclear Chain Reaction in the Second World War" was the exemplar of how "a state of war can stimulate the scientist to great feats of the imagination and to great practical achievement."*

*From the lectures on science and military affairs in late 1965 by Sir Jolly Suckerman, collected in the volume "Scientists and War" pages 47-48, 1966

Along with the leaders was that extraordinary aggregation of teams - probably ^{quantitative} larger and ^{more} spiritually as well as organizationally/integrated than any in history; and, therefore, for that company of researchers we need to recapture the original meaning of company in the days of the exploration and settlement of this Continent, to wit 'companions in adventure', still preserved in the label for a stimulating product that attributes its source to "The Governor and Company of Adventurers Trading to Hudson's Bay."

Reflecting further on the maintained international character of the exploration across the frontiers of the new knowledge it is noteworthy that the British group considerably earlier and the American group later but independently thought through qualitatively and quantitatively to common and virtuously and

practically identical results. That, too, may be set down as an absolute first in the history of science (assuming permissibility of such judgment to a non-academician). Upon one who, as will be shown later, was vouchsafed by his close relationship to Lord Lothian, the then British Ambassador, to gain glimpses of some of the British ^{such} formulations - as the remarkable Frisch-Peierls Memorandum on "Superbomb Based on Nuclear Chain Reaction in Uranium" - and conveyed the tenor to the President, it is incumbent upon that one to bear tribute to that collaboration by the British, yet to register at the same time a probability judgment that for the requisite high acceleration - into a small fraction of prior time-spans - for the production of the bomb the translation of the imaginative pure science into the applied, needed the integrative direction as well as the enormous resources that the U.S. marshalled and utilized.

Refocusing on the theme of the future vectors that were involved, we have to distinguish them from both (a) current economic and related projectionism and (b) the more restrained dealing with future alternatives by professional historians. As for the economic and social conditions in time-tracts ahead - for which my friend Baron Bertrand de Jouvenel, eminent French political-scientist, has given the name "Futuribles" - that is very different from particularized programmatic decision making. The latter has many more variables, the selection from which is the crux of the task.

As for the type of the limited looking on "what might have been" indulged in by the historian, since his preoccupation is with a completed past the future ^{or} is indeterminate in terms of the participants in the struggle, but/the historifier and the later historianator of historification the issue is between alternative futures for mastering the predicaments of the present. The historifier's decision-making and his embarked upon enterprises require not only a projection of probabilities but enactments to avert the undesired alternative, even if it has been adjudged to have a lower probability than the desired one. For as long ago discerned by Aristotle, "it is part of probability that the improbable can happen." Accordingly, the new science prosecutor emulates the historical agent and follows a variety of courses in testing out stages that show up declining probabilities or in the event that they are not reduced tries, if he can, to follow through on and carry out that alternative.

**As a pointer to a task in a chapter beyond the present work, namely the designated phase two, attempt will be made to demonstrate from thus far neglected documents that contrary to the hindsight indulged in by many physicists and political scientists, the top policy leaders of the project would have had no right to risk a fanatical war of prolonging Japanese resistance by the Kamikaze or the naval suicide squads, in a situation where on the evidence available to this former

special consultant to O.S.S. Director, General Donovan, the majority of the Japanese Cabinet was even then ready to reject the American terms. The emotional reversion of a number of esteemed scientists to self-repentant pacifism must in part be attributed to the thus far neglect by academic historians of the distinctive characteristics and obligations of judgments and actions in the flux of critical eventuations by historifiers who are trustees for the Nation in this case the obligation that rested upon the great Henry L. Stimson and all of his associates to prevent the over million casualties that were estimated as the cost in the event of being compelled to invade Japan. **

For The Twenty-Fifth Anniversary Observance

First Nuclear Chain Reaction,

December 1 and 2, 1967

The University of Chicago.

[Atomics]

V. Eng. Ref. v. the Secy Mc Mahon look author

[Reports, Studies, Mem
Atomics]

Excerpted Parts From:

ATOMIC PROJECT'S COMPLEX ORIGIN AND ENSUING
SCIENTIFICATION OF UNITED STATES

THREE-PHASE PROGRESSION OF HISTORY-TRANSFORMATIVE MUTATION IN
RELATIONS GOVERNMENT AND SOCIETY TO CREATIVE SCIENCE FOR NATIONAL SECURITY AND PROGRESS:

PHASE 1. THREE YEAR STRUGGLE FOR GOVERNMENT COMMITMENT TO PROJECT:
(APPLICABLE TO FERMI CELEBRATION)

(REMAINDER FOR COMPLETING BOOK:)

PHASE 2. FOUR YEARS FOR EFFECTUATION APPLIED ATOMICS OF WEAPON FOR
WAR SHORTENING AND LIFE SAVING FOR U.S. ALLIES AND JAPAN; AND

PHASE 3. POSTWAR TO DATE DEFENSE PROGRESS FOR SECURITY AND GOVERNMENTAL
FOSTERING OF U. S. SCIENTIFICATION

BY

ALEXANDER SACHS

Late-November 1967 -
End- February 1968

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Accordingly, this venture by the initiatory proponent and sustained protagonist over the life of the Project - moved by entreaties to set the history straight - has been keyed into two commemorations by the University of Chicago as pivotal figure in the Project's/origination; in whose nearly contiguous experimental

celebrations it has been his privilege to participate. The instant tuning-up for the Twenty-Fifth Anniversary Commemoration of the First Nuclear Chain Reaction at opening-December 1967 recaptures a note that was struck a year ago by the writer as speaker at the Seventy-Fifth Anniversary of the University of Chicago's founding. That note was that the Renaissance of Science in this century - matching the 17th century's role as the "Age of Genius" in Whitehead's term - had been proceeding up to World War II across converse rather than parallel developments in the Western World as a system of power. After the victory in the Great War of 1914-18 by the Allies and the US, first the European members of the Coalition struggled with reconstruction through the Twenties, then the US joined in the common Great Depression, and then across the striven-for but unfulfilled recoveries of the Thirties these carriers of Western Civilization became characterized by declensions in military and political power and also prospects over against the resurgent European powers that had undergone defeat. The designated Great War, which was prosecuted as "the war to end war," was in the aftermath followed by disillusionment and self-distrust, that in turn, after the Great Depression, evolved into defeatism and appeasement.

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Focusing on the closing member of the just defined triad of historical forces, the pattern of persecution and ensuing migration has, alas, been traced recurrently through history: In respect to the shifted loci of intellectual activity, notable exemplars were the sequels to (a) the Spanish Inquisition; (b) the French terror against the Huguenots at the end of the 16th century that compelled hosts, including Descartes and the parents of de'Moivre, to seek and find sanctuary in Holland and England and their colonies; and (c) even the milder discriminatory treatments by reactionary regimes that brought to the US shores a non-conformist entrepreneur like duPont prior to the French Revolution and later the German and other Continental Forty-Eighters. This historical

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8.

The eventually entered upon Atomic Project itself had a very long and rather unique experimental overture for deciding its practicability. An analogy for that type of overture is the newly evolved form of musical composition, where a small group instead of following an already singly effected composition carry on dialogue and trials with the directing composer, as to which themes to use and how they should be followed. The equivalent to this novel co-composing was pursued as we will see by the joint experiments of the Columbia group, starting with Dr. Fermi's team of Henderson, Zinn and Szilard. Indeed Fermi was also a genius in his hospitableness to suggestions and in his sharing with team-mates the hard tough working say with carbon soot.

Still another unique feature needs recognition and description, just because it has not yet been put on record. The refugee-or-exile scientists up to the outbreak of World War II and for a small stretch afterwards, were in human vibrancy to what was going on abroad and being reported abroad in correspondence from their scattered links as well as from received publications. This contemporaneous watcher of the letters in Nature on aspects of uranium fission kept collecting his series up to the very end of 1939, by which time he had over a couple of dozen, with the last one in the issue of December 23, 1939 having been written by a member of the Radiological Laboratory of the Warsaw Society of Sciences under date of September 24, - doubtless

**Asterisks in place of italics

Force Commands fostered the improvement by scientists of the Watson-Watt transformation of radio methods into radar, as adumbrated and begun early in the re-
armament. Interestingly, it was not only a reversal of the halting and inadequate adaptations of science to defense in World War I but also a return to the British science in its early Royal Society phase of unclutteredness and easy fusion of practical empiricism normal academicism and reflective amateurism. It barked back to the advice by Sir Isaac Newton: "Instead of sending the observations of seamen to able mathematicians at land, the land (should) send able mathematicians to sea; it would signify much more to the improvement of navigation and safety of men's lives and estates on that element" (in current spelling from "The Correspondence of Isaac Newton", Vol. III, p. 364, Cambridge University Press, 1961).

The by then self-liberation, under the too long toleration of discrimination, from their pacifism made them critical of neutralist and isolationist attitudes in the U.S. of 1939-1941. Therefore, they were impatient of our tempo of progress on the Atomic Project. As the United States was in the fortunate position for utilizing what in my March 10th Memorandum I called "Short-term Credit Line on the Bank of History" for preparedness, these newly attached scientists became avant-garde in impelling and accelerating work on the Atomic Bomb.

Significantly, there were corresponding far more influential groups from among the native American scientists, who had led in the reorientation by the scientific profession towards the issues of freedom for science and of consequential national defense. Their personal and professional relations to the British scientists were heightened through communications with the Maud Committee and trips to Britain while we were still neutrals. The group's favorable opinions of British work completed the crystallization of the U.S. practical decision.

Thus, the collaboration between the experienced Research Directors that the President picked and the teams they picked with broad-minded scope for the newly attached scientists - all that completed over 1940-1941 the overture-playing and entry on the active programatics of the Project.

CHAPTER II.

ON PRESIDENT ROOSEVELT'S CONTINUOUS LEADERSHIP TO NEAR THE END, CULMINATING WITH CALL ON THE DIRECTOR ATOMIC PROJECT FOR PROPOSALS FOR POSTWAR SCIENTIFICATION US

In view of the utter novelty of the questions that had to be cleared before launching the Atomic Project as an enterprise keyed into war-instrument, the emphasis in the prior Section on future-orientedness applied in distinctive ways to the President's role. Here, too, the addition of press and communications media to dramatization of decontexted events initiated and preserved the fictional and mythical notion of an instantized authorization by fiat of the eventuated Atomic Program. In radical divergence from that, what the President and advisor inaugurated was a procedure of exploration under a devised new auspices: acting through representative governmental and scientific figures along with this advisor for (a) reaching preliminary decisions on the questions to be cleared - while (b) aiding the research - and then (c) recommending lines of action. Thus the President did not, per the publicized "Story", transfer authority by complete delegation. Indeed, he not only retained it, but concernedly followed developments through the official channels of the Ad Hoc Committee supplemented by advisory communications and consultations.

A.

While the setting of and the sequel to the conferences with the President on October 11th-12th were sketched in what was, so to speak, the first historical unveiling of the momentous events, namely in the testimony by the writer that opened the Senate Hearings shortly after the end of the war (November 27, 1945), the then original plan by Chairman McMahon was for two presentations, - the second of which was to have given lights on the President's concepts of the Project. But as pressing Senate business intervened after the first and long presentation (as per page 572 of the revised transcript), it proved difficult

to arrange a mutually convenient follow-up. Hence this is the first occasion for an explication of aspects of the President's multifaceted conspectus on the tasks. The first in terms of immediacy and also the equivalent of a base was the need that our country be assured remaining au courant and also placing itself ahead of other countries in atomic research under war conditions. For prudence required of us that Nazi Germany, having cowed Europe by its accumulation of the most technological weapons, would be investigating the feasibility of an atomic weapon. For the superstructure upon that base, the problem of feasibility of an atomic weapon, or the advisor's code words of "exponential weapon," presupposed the effectuation of not only a nuclear chain reaction, but one that was controllable. And while there were a few, here and abroad, who deemed it probable as against the preponderance of eminent experimenters who regarded it only as a possibility, all realized that it had to be proved experimentally and practically. But inasmuch as even in November 1939 the two representatives from the Armed Services - who in a report to the President acquiesced in exploratory investigation - were aware that the then medium for resources, the Lea Bill, was still before Congress, the crucial question in discussion with the President was that of a "time-schedule," to use the President's expression. Expressed differently, though the experimenters in the universities and related scientific organizations were primarily concerned about funds for continuing enlarging experiments at rising but still very moderate costs, literally not a one on the Advisory Uranium Committee raised to himself the question beyond chain-reaction feasibility, namely how long it would take to go beyond the pure physics into the securing of the ultimate technology of a weapon.

With a view to further light on the situation in the closing months of 1939, having detoured the whole question of opposition by the Services by making the post-fission atomic research a subject matter for the Bureau of Standards, the President's primary question was, 'How long would an Atomic Bomb take?' The Bureau's Director replied to General Watson

that the Presidential question was all 'too too previous even to consider'. The same was the reaction to the question about 'guessable ranges of costs'. What the scientists were asking in the way of aid for the then proceeding experiments was so minor as to be non-relevant to what would emerge when practical tasks would ensue. The suggestion submitted from what was called the 'Scientists' end by the Director of the Bureau to the President's Assistant, General Edwin Watson, was this: 'only in a far advanced stage in technical projects in swing can the engineers in charge project from their budgets and pace of progress and thereby make guess-calculations'.

In that situation the non-physicist^{was} pressed to try to make guess-estimates on a subject that was so to speak in a pre-nascence stage for investigation.

The advisor's approach was to start with the more crucial of the two problems, namely, how long might it take? No sooner stated but the novel and crucial modification had to be inserted since mere adaptation of past time-spans by application of conventional projections would fore-close the feasibility of the Project as political economy for a war-situation. For what was to be historified as a novel single event the normal probability and projection techniques are refractory, because dependent upon so-called "laws" from frequency distributions based upon past events. *

* This thesis has recently been reaffirmed by the longstanding Chief Scientific Advisor to the British Government in an address given by him in May, 1961, at Supreme Allied Headquarters, Europe, in the following declaration: "The validity of probability methods when applied to single events is an academic matter ((and also practical matter)) which has not yet been sorted out... If ((in defense and war-situations)) we decide wrongly...we shall be in a situation which may never repeat itself, which may end the leadership of the Western World..." "Scientists and War", page 120.

Yet, experience with cognate situations does lead to procedures of adaptability to large deviations from past patterns. It so had happened that as a professional economist interested in science and technology, the writer had cultivated what he then called "Originative Macrotechnical Innovation by the Enterprise Order". His laboratory case was the new energy industry of public utilities evolved from the pure science of electricity and the applied one of electrical manufacturing. His tentative ranges of estimates for the time-span in years for the emergence public utility industry in the United States, were submitted to a high official of the Electric Bond and Share Company, which as a financial invention of the late Charles Coffin of General Electric and the elder, J.P. Morgan, had surmounted the obstacles to rapid electrification of municipal lighting. That late Mr. May of Electric Bond and Share from inception to the Thirties -- when this economist sought his assistance -- did confirm that the time-span for the emergence was 30 to 35 years (starting not from the time of Faraday but from the end of the Seventies when the German science-trained industrialists standardized electrical terms and began commercial production) Now, inasmuch as for both Europe and the United States the shift from municipal lighting to industrial electrification had been delayed by the Great War and that aftermath of Depression of the early Twenties, an adjustment had to be made, so the 30 to 35 was reduced to 20 to 25. Still another quantum jump in revising past history was adopted, since on the data assembled for both Europe and the United States it was clear that two sets of obstacles delayed electrification: (1) resistance to thereplacement of gas lighting by municipalities, and (2) the inadequacies in marshallable financial resources under the pattern of sequential entries by individuals and companies in

limited scale and having to undergo liquidation and later takeovers. That adjustment brought it down to 10 to 15 years (Again the reductions were not mere statistical guesses but the synthesis with judgments by a high official who had lived through the whole process of electrification of the United States and whose parent-company had been in very close connection with the German General Electric (AEG), and which later was influenced by that pioneer in electrical science and technology, Charles P. Steinmetz. On all this was superimposed still another conception by this venturer in "Original Macrotechnical Innovation": Suppose, in addition to avoiding the historic obstacles from sequential enterprise with inadequate capital, the founding enterprises also surmount the trial and error phases applied to uncertainties from the start as to which alternative methods would prove the experimentally and the commercially successful one. This would be equal to emulating the concurrence of diverse themes in musical composition and the unfolding of the themes with altering emphasis in the light of experience. The difference, of course, would be that the criteria for shifting the emphasis would be emergent practicability instead of ^{esthetic} suitability and complementarity. That suggestion was submitted to my so valuable advisor in the late-Thirties, when I sought to apply my prior labors for an answer to that question in political inventiveness that confronted the President. My own consultant said "You write down your guess and I'll write down mine". He cut each member of the range in half, or ^{to} the range of 5 to 7½ years, and the younger economic researcher cut it down to by 60%, or to 4 to 6 years.

As a since accrued test of the validity of the historic average derived for an admittedly more progressive industry than the composite of new American

industries, it is interesting that it is broadly confirmed in a report that was released in 1966 on "Technology and the American Economy", from which the summary table is reproduced as an Appendix to this Section. The total development in mean-lapsed years for technological innovations from a closing span of the Nineteenth Century to the end of World War I is given as 37 years; and that for the post-World War I period as 24 years; Since the new energy of electricity was more advanced than the others according an equal weight for the second epoch with ^{the} longer prior epoch can be justified and such straight average turns out to be 30 years, over-against the higher figure of 34 years or near our upper range for industrial technology. The very lowest figure of time-span -- keyed into presumed favorable situation where the problem of adequacy of funds would not arise -- appears to be that for "Federal Government" with about 20 years.

The just suggested approximations to rather than full confirmations on the enclosed table may explain why advisor and advisee, as early as 1940, thought the bold net lowest figure of around 4 years had plausibility as to attainability. Since that last figure was about one-tenth of the upper part of the range of 35 for electricity and 37 in the 1966 estimate by the report on "Technology and the American Economy, the low figure was humorously referred to as the AD (the Alexander Decile).

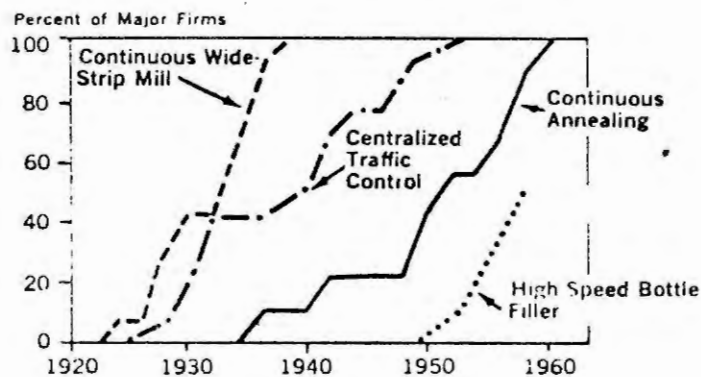
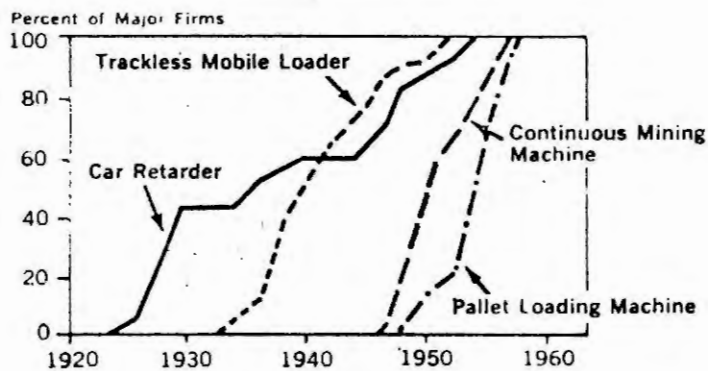
As for estimates of cost, an undertaking was carried out by the advisor to assemble from the Stock Exchange Intelligence volumes in European countries and financial manuals in the United States over the longer history of electricity and electrical utilities enterprises data on new issues from the Eighties on. For this personal and totally non-governmental project the advisor utilized connections in the capitals of Europe, who had

Factors influencing the rate of technological development	Mean lapsed time (years)		
	Incubation period ²	Commercial development ³	Total development
TIME PERIOD			
Early 20th century (1885-1919)	30	7	37
Post-World War I (1920-44)	16	8	24
Post-World War II (1945-64)	9	5	14
TYPE OF MARKET APPLICATION			
Consumer	13	7	20
Industrial	28	6	34
SOURCE OF DEVELOPMENT FUNDS			
Private industry	24	7	31
Federal Government	12	7	19

¹ Based on study of 20 major innovations whose commercial development started in the period 1885-1950.
² Begins with basic discovery and establishment of technical feasibility, and ends when commercial development begins.
³ Begins with recognition of commercial potential and the commitment of development funds to reach a reasonably well-defined commercial objective, and ends when the innovation is introduced as a commercial product or process.

Source: Frank Lynn, *An Investigation of the Rate of Development and Diffusion of Technology in Our Modern Industrial Society*(1).

Figure 2. RATE OF DIFFUSION OF SELECTED TECHNOLOGICAL INNOVATIONS
 Percent of Firms Adopting Innovation, 1890-1958



the simple task of just jotting down the size of capital flotations, as irrespective of favorable to unfavorable performances on expenditures were relevant to the cost of the building up of the electrical industry there.* The same procedure was based on the same principles that were applicable to the United States. - For the aggregate of costs over the alternative time-spans used a median was adopted and it amounted to about \$1½ billion. To that had to be added a guess estimate as to what would be the increment of inflation. As to that, this economist thought rather than merely hoped that the management of economy of this time would be far superior to that of the Great War in its two phases of exceptional price push under Allied purchases during the Neutrality phase and, second, our full participation in the War under conditions of great shortages of materials and manpower. So, instead of very high increment near doubling of price the adopted multiplier was one-third.

In consequence, the guess estimate of costs of the Atomic Project under war conditions was around \$2 billion (this is the basis of the reference by the writer in the "Look" magazine of March, 1950, on the basis of then examined preserved papers). It happens that, and it must be attributed to the Grace of the Lord or a Thomas Hardy "Spirit of the Pities" for statisticians, the figures approximate to the estimate of the costs of the Manhattan Project from 1942 to 1946 at \$2.2 billion, as shown by the table on page 724, of the "Official History" (as 1946 by itself entailed a cost of \$281 million, deducting that and adding the unreported figures for Government advances for 1940-1941, the adjusted figure would be very close to \$2 billion).

*Tribute needs to be paid to the assistants for having in the British case generally used the honoraria as contribution to the British War Relief, and in the case of assistants in continental neutral countries for having generally used their honoraria for aiding exiled scholars.

B.

In keeping with the indicated necessity of synthesizing the unprecedented nature of the enterprise with fresh concepts and methods of probability, this section on the President's attitudes and relationship to the project has to embody in this comprehensive historization of the project an adaptation by the advisor of a theory of probability that instead of featuring the element of average featured the element of uniqueness in terms of the importance assigned to the enterprise's success. This subject, though it was reviewed by the historian of the Atomic Project and articulated in the follow-up letter to them of September 29, 1959 had to be passed over. Yet, it is obvious to all readers of the Churchill volumes on the war that the labors of leadership required a combination of faith and reason, without which the burdens of leadership would have been superhuman. The basis of the type of probability that applies to supremely important unique occasions was long ago formulated in the introduction to Bishop Butler's "Analogy of Religion." Hence a condensation of the condensation from that letter of mine to the historians of the project is presented here for the illumination on President Roosevelt's acceptance of and repeated pressures for overcoming difficulties in decisions by his designated authorities in the execution of the Atomic Project.

* The very first sentence of that introduction to the Analogy is this: "Probable evidence is essentially distinguished from demonstrative by this, that it admits of degrees; and of all variety of them, from the highest moral certainty to the very lowest presumption." The most distinctive part of that theory is as I defined it the recognition of the validity in life of weighing probabilities not merely by their internal degrees but by the estimated sense of importance and concern that the man making a judgment attaches to what is at stake in ~~the~~ probability choice. It represents the affirmations that man, as a moral and spiritual being, makes for himself and as a trustee of interests under his care as to the objects of his great solicitude. In Bishop Butler's formulation it is as follows:

"For surely a man is as really bound in prudence to do what upon the whole appears, according to the best of his judgment, to be for his happiness, as what he certainly knows to be so. Nay further, in questions of great consequence, a reasonable man will think it concerns him to remark lower probabilities and presumptions than these; such as amount to no more than showing one side of a question to be as supposable and credible as the other: nay, such as but amount to much less even than this."

The net import of the foregoing considerations on probability as guide to vital choices was that it is the office and the duty of the statesman in relation to this kind of research project to make a greater venture of faith than was permissible on a calculus of business probabilities. This attitude was carried further into the thesis that our utilization of this unique assemblage of creative scientists constituted a unique dual opportunity for enabling us to get ahead of Nazi research in this potential weaponry and for influencing the whole tone and sweep of work in the frontiers of science for overcoming the Nazi advantages in technological warfare and thereafter for maintaining leadership in science. The accrual to the United States and Britain of this creative science entailed what I called a mutation in the history of the relationship between the pursuits of pure and applied science and the bodies politic and economic, namely whereas previously the prosecution of pure and applied science was delimited in scope and piecemeal in process, henceforth they would have these new dimensions of national and international welfare.

In reinforcement, an analogous formulation by William James, whom President Roosevelt had known in his college days, was invoked as follows:

"The world puts all sorts of questions to us, and tests us in all sorts of ways ... But the deepest question that is ever asked admits of no reply but the ... turning of the will and tightening of our heartstrings as we say, 'Yes, I will even have it so.'"

*With slight changes for the extra condensation it is almost verbatim from the letter, pages 11-13.

C.

As the foregoing Sections have striven to illuminate the influence upon the President of his basic faith and a history-derived potential probability, - the latter as to attainability in time of a weapon that could shorten the war - it is necessary to throw additional light on the great concern that he, in common with Winston Churchill, had had to prevent the Second World War from sinking into that life-consuming 'attrition' that had characterized the First World War. Only recently have we been accorded an adequate picture of that terrible Heart-break House that was experienced by the Allies over the course of the war of 1914-18. Sir Llewellyn Woodward, in that recent book, Great Britain and the War of 1914-1918, attempts to describe the consequences in human losses from the difficulties, under trench warfare, of either side to effect decisive blows, and how the lack to the Allies of significantly advanced scientific weapons brought in train enormities of human losses by which, as he put it, the victorious generals "nearly destroyed European civilization by the methods which they employed to save it." In the course of his description of the war in the field, Sir Llewellyn follows Liddell-Hart in pointing out that the failure to have pursued with urgency from the start the development of the tank can be held responsible for such huge losses as the twenty thousand British dead on the first day of the Somme, which "stunned and deafened the imagination" and left "the personal anguish beyond description." The Liddell-Hart analogy for italicizing the 'unuptodateness' of applied science for that war is as follows:

"No admiral in the 20th century would have sent wooden ships against an armored battle squadron, yet the leading professional soldiers of Europe allowed their attacking infantry to cross zones of fire with less protection than their predecessors of the 17th century had available for themselves against a much weaker defence."

Inasmuch as President Roosevelt, after his service in that war as an Assistant Secretary of the Navy, remained a close student of that war, - and its weaponry-inadequacy as a cause of what for Europe was "the Lost Generation" - the expected weapon-outcome from atomic research was regarded by him, and also by Churchill, - during the latter's visits to the White House - as US insurance against two contingencies, to wit a probable war of attrition by Japan, notwithstanding naval losses, and a less probable prolonged last stand by Nazi Germany through guerrilla warfare. As to the first contingency, it must be borne in mind that during the closing months of 1944 Secretary Forrestal thought it so probable that just before Roosevelt's death, at Warm Springs in April 1945, he had recalled the then Captain Zacharias from the West Coast to prepare and deliver the broadcasts in Japanese, aimed at converting the Japanese Imperial Household and the Cabinet to accept surrender on a basis which did imply preservation of the Imperial Household. And notwithstanding the hindsight-dogmatism by some historians and scientists, we do have the evidence from Secretary Stimson's memoirs that the General Staff had planned for a Far Eastern War in July 1945 by invasion that autumn and, in his own words, "such operations might be expected to cost over a million casualties to American forces alone."

With mindfulness of the concepts developed in the preceding Chapter for integrating the three time-dimensions, - of past as plastic material in managing present predicaments for willed objectives in the future - we can now appreciate not only Roosevelt's interestedness but periodic propelling of the Atomic Project in its military aspect. Thus, as is reported in the AEC's official history, The New World: 1939-1946, there was a report at the end of March 1940 which was "disappointing". Then, in acknowledging a communication from this advisor, the President, on April 5, 1940, "asked General Watson to arrange another

meeting in Washington at a time convenient for Sachs and Einstein. Roosevelt thought Briggs should attend as well as representatives from the Army and the Navy," and concluded his letter by declaring: "I shall always be interested to hear the results." The next sentence in that official history is this: "The same day, Watson sent Briggs a copy of the letter to Sachs and asked for suggestions 'so that this investigation shall go on, as is the wish of the President.'" (pp. 21-22, italics now added) ✓✓

D.

As a final and totally new disclosure, it is necessary to include here in resumé-form a "Flash-Forward" on the climactic effort by the President, towards the end of his life, to prepare for the metamorphosis of the Atomic Project into what in the title of this recaptured history is called Scientification of the US. In accordance with the orientation of this writer towards newly accrued history, or historification, and with the basic objective of historians being future-ends-oriented, it is not only advisable but necessary to afford the reader glimpses of actions by the President, right after the elections of 1944, to request Dr. Vannevar Bush, as Director of the Office of Scientific Research and Development, to think forward and to evolve, through diversified consultation, proposals and plans that would lead to the Scientification of the US. There happened to have been presented to the President, just before the election, a confidential evaluation by this writer, entitled "Final Phase European War and Emerging Opportunity for Liquidating Far Eastern War." (Exhibit 1 to Chapter II) That memorandum, by one who was following problems of strategy as a Special Consultant to General Donovan as OSS Director, averred that "the end of the European War ... should be between April and May." Further, it rejected even a minority probability of "prolonged guerrilla warfare," and for set-

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forth reasons stated that "the eventual military collapse will dovetail with the total political collapse of Germany"; and for further reasons held that "there will really be nobody to surrender, but only commandants in selected areas." Consequently, the next task was to utilize the "opportunity for liquidating the Far Eastern War by rational deviation from our formula for Germany." That deemed modification in reassurance of the Imperial Household was based on an appraisal that "the social structure of Japan is in a far better position than Italy was to effect an exit from the war similar to that which American and British political leadership was wise enough to accord to Italy." (end-page 5 of the confidential evaluation)

* * *

It is against the above reasoned foreground that the recommendation was made in November 1944 for preparing a transformation of the Atomic Project from the imminently achieved weapon and its ensuing use for forethoughtful rapid attainment of victory and life-saving into the mediation of prospective Scientification of the US. Since the original letter by President Roosevelt of November 17, 1944 and the eventual reply to the President over half a year later, on July 5, 1945, - noteworthy before the surrender of Japan - are extraordinarily clear documents, that dust - hitherto unconnected with the Project - is included as an exhibit for this total report as the ultimate climax and justification of the Atomic Project. (Exhibits 2-3)

EXHIBITS TO CHAPTER II

Exhibit 1 to Chapter II

CONFIDENTIAL EVALUATION
TO: President Roosevelt

FINAL PHASE EUROPEAN WAR AND
EMERGING OPPORTUNITY FOR LIQUIDATING FAR EASTERN WAR

By

ALEXANDER SACHS

End-October - Early-November, 1944

I. EUROPEAN WAR CLOSING

A. APPROACHING MILITARY COLLAPSE OF GERMANY

1. We should be across the Rhine by the end of this year and, if a counter-offensive materializes, by early next year.

2. By now Germany's lack of adequately trained and equipped manpower deprives it of improvising any defense-in-depth. Rather, it is a mixture of powerful front line mingled with weaker members utilizing such defenses as survive the bombing, and behind it there are weaker and weaker positions down to mere shell.

3. The end of the war will be accelerating piecemeal operations. The timing should be between April and May.

4. The tough phase will be the Rhine and the Ruhr. The arnhem episode of September means that there can be no circumvention from the northwest. But once the Rhine is crossed and the Ruhr defense positions turned, then we should be getting into plains and have smooth, swift passage, eventually toward the Elbe.

5. The converse operation from the east would be that once the Russians break the German defensive positions in Hungary, they would be moving westward and eventually converging on Berlin.

6. As the convergent operations from the two ends crumple the central system of German defenses, then the South and North ends should accrue to us by the disintegration of the central military position of Germany.

7. The foregoing presumptive preview is tantamount to a challenge of the popular thesis of a long-drawn-out series of last-ditch defenses in the mountains of Thuringia, Bavaria, and the Italian Alps. The surviving pockets will be isolated and will eventually fold up. Because people in the past have

been much too previous in their forecasts does not mean that the leviathan can survive at the termini when the central part is destroyed and the feeding lines immobilized. The theory of prolonged guerrilla warfare is another illustration of wing-shot resort to analogies detached from a rational base. Guerrilla warfare appears to this writer most implausible at the tail end of a long war of attrition and in the phase of narrow cornering of the German Dillingers. Sometime by the spring of 1945 we can look to such a destruction of the industrial sources and such a detachment of the army commands from the arteries of potential supply that will rule out the practicability of independent last-ditch positions linked up by underground and guerrillas.

B. APPROACHING COLLAPSE OF THE NAZI SYSTEM AND STATE

1. If the foregoing theory should become validated by events, there will be afforded a signal corroboration of this writer's synoptic orientation on the progress of the war telescoped into the syn-estimates of comparative war efforts. The pulse of the plight and the prospect of the salvation for our cause has been registered on the counterpointed readings of the War Expenditures in Total and in Combat Munitions of the Members of the Alliance Against the Axis Since 1938. (We have thus far timed with extraordinary closeness the periods of the major offensives related to current and to cumulative comparative positions.)

The projected date for the end of the war as spring 1945 has been related to an attainment of accumulated munitions expenditures by the Allies in excess of double the accumulations by the Axis since 1938.

2. It is expected that the eventual military collapse will dovetail with the total political collapse of Germany. Those afflicted by the type of thinking that I have called "parallelitis" - based upon too close parallels with the past - have found it difficult to envisage how the unconditional surrender

formula can be applied and have repeatedly fallen back upon formulas of negotiation with alternatives to the Nazi regime. But I am convinced that the great deliverance to come should and will conform to the profound historic and cultural logic of the challenge represented by Nazism. The great fact about Nazism, as this writer succeeded in crystallizing it in the very midst of the "White War" victories of Nazi Germany, is that it is the first attempt in history at deliberate de-politicization, de-societization, and de-civilization of a people and a culture.

The Nazi system is:

"Tyranny implemented with modern technology, deliberately uprooted from the Western tradition of an ecumenical order of law and conduct that in principle has been common to the variously articulated societies that compose the Great Western Society particularly since the Renaissance."

This retroverted primitivism via tribalism fused with technology will, once the control over technology is broken, literally fold up. The top Nazis may personally want to go through a Wagnerian immolation. But there can be no transmissible power from them to hold Germany together because there is no social system and no cohesiveness that is independent of coerciveness. Hence there will really be nobody to surrender, but only commandants in selected areas. Thus the understanding of Nazism is itself a clue to the final liquidation of Nazism and the Nazi State.

II. OPPORTUNITY FOR LIQUIDATING FAR EASTERN WAR BY RATIONAL DEVIATION FROM OUR FORMULA FOR GERMANY

The link just made between a proper understanding of the nature of Nazism and the liquidation of Nazism as a system of power points to the equally vital need for differentiating our Far Eastern from our Western enemy. For the prospect of successful action by statesmen in the flux of history depends upon an adequate understanding and evaluation of the nature and the momentum of the

historical entities themselves. By contrast with Japan, Nazism emptied out the political and social structure of Germany and within that "swept and garnished" order it inserted a technological tyranny uprooted from all tradition. In the current Japanese imperialism, however, there has been preserved to a remarkable degree the institutional structure accumulated through history. In the light of the following notes on the continuity of the political and cultural history of Japan, the progress of Japanese militarism since the Thirties is an adaptation in contemporary terms of the old pattern of Japanese imperial expansion.

The initial project in the wake of the breakdown of Czarism was to detach Manchuria from the rest of China while holding Russia neutral, and then to extend into the Chinese mainland. The practical separation of Manchuria from the rest of China was effected by the mid-Twenties as a result of the prolonged revolution and the disorganization of China itself. When the second opportunity came in 1931, the West was too deeply immersed in the greatest economic depression of modern history to implement portests into military intervention. The next and far more important aggression on China in the summer of 1937 was embarked upon only after an internal struggle within Japan and the overcoming of opposition by the influential liberal elements in the Japanese political system and the potent concentration of big business. The mutiny of the militarists in February 1936 was formally exorcised by the ceremonial atonement, but in large measure was rendered successful when the militarist element gained notable representation in the new Cabinet. Then ensued enlarged government investment in Manchuria, nationalization of the electric power supply and other capital investments for large-scale armament in a technological world. In the effectuation of this preparedness, the Japanese liberals were subjected to pressures and persecutions analogously to those which Japanese Catholics were subjected to in the sixteenth and seventeenth centuries.

It was in the midst of the economic and social disturbances that the army in the summer of 1937 moved across the Marco Polo Bridge into Northern China. But the war on China did not produce the complete and quick victory originally expected, even though, to continue the historical analogy, there was no Chinese fleet to repeat the feats of the Koreans against Hideyoshi's aggression.

The signing of the Soviet-Nazi agreement of August 1939 affected the diplomatic isolation of Japan by appearing to break the link with Germany that had been forged by the agree-

ment of 1936. But after the fall of France that link with Germany was restored. On the theory that America would be preoccupied with the consequences of German mastery over the whole Continent and the attendant threat to the security of the Atlantic-bordering countries, Japan decided to embark upon its southward expansion. Thus we witnessed a transposition of the historic pattern set by the Hideyoshi Tokugawa expansionism. Japan then emulated that apostasy from the West which Nazism represented and fostered, analogously to Nazism, retroversion to cultural primitivism fused with the most up-to-date technology. Thus was projected Japan's new structure. When Germany, after reducing the whole of Western Europe to captivity, marked into Russia and reached the gates of Moscow, Japan embarked upon the largest military adventure of its history and committed the treachery of Pearl Harbor to immobilize the American fleet and to secure cover from attack for the landings in Southeastern Asia.

Within a year and a half of the check administered by our successful naval battles of Coral Sea and Midway, it became clear that Germany was stymied in Russia. The absorption by Japan in 1942 of the British and Dutch Far Eastern possessions began by late-1943 to prove a liability because of the very inability of Japan to convert the captive areas to economic and military uses.

Skipping over the details of the mutually reinforcing successful strategies of the Allies in Europe and the Far East, the prospect of total destruction of the German military power and the internal collapse of the German system as described above must mean such a massive and resourceful concentration against Japan that, on the eve of such victory over Germany, a struggle must emerge between the military and the preserved political and social forces. For Japan will then present the unique spectacle in history of the Great Power with its military force dispersed over distant conquered lands and its homeland unprotected against armadas from air and sea.

It is against this condensed yet luminous background that we have to fashion a new political strategy for the surrender by the resurgent Imperial House of the homeland in order to save it from total annihilation.

It is submitted that the social structure of Japan is in a far better position than Italy was to effect an exit from the war, similar to that which American and British political leadership was wise enough to accord to Italy. The Imperial Household has preserved in its intimate association with the leaders

of the very big business that are anathemized by our publiciam. True, both parts of the body politic and social of Japan have accommodated themselves to the militarist domination. But the preponderance that the militarists had secured in 1931, 1937 and 1941 has in the last two years turned from military successes to defeats. Meanwhile, the combination of the Imperial Household and the social-economic aristocracy has preserved a sufficiency of rights which, with the cumulative evidence of eventual total defeat can be converted into a recapture of power. Unlike the German industrialists and the German civil service, the corresponding Japanese classes can point to a record of resistance to the aggression of the militarists upon the internal political order of Japan. They can point to the probability that they came near winning out in Japan in 1937, up to the Marco Polo Bridge episode of the militarists against North China.

Between now and the fall of Germany these elements are bound to become more vocal and influential. The strangulation of Japan that we will be able to effect at a distance will make the broad masses regard the military as the cause of their misery. Had the limited-scale expansionists along with the anti-militarists succeeded in keeping Japan out of the war, Japan would have profited more from this than from the last war. However difficult and disputable any rewriting of history must be in terms of keeping only one variable altered, it is an hypothesis close to certainty that Germany would have made war even if she did not have Japan with her. Then Japan would really have built up an "East Asia co-prosperity sphere."

Looking ahead, Japan can have neither a Dunkirk nor a Stalingrad. For no one can come to her aid. The only question is whether a duet or a triad of powers - whether we and Britain together, or reinforced by Russia - will give the last decisive blow. The more one reflects on the utter hopelessness

of the outlook for Japan from spring on, the more confident can one be that Japan's ruling House and classes will not engage in national suicide. This means that the talk so glibly indulged in by military commentators of two more years of war against Japan is as unrealistic as the talk of a Hitler-directed guerrilla warfare after we will have taken the Ruhr. Moreover, ^{with} the augmenting military operations and exponential weapons, the coup de grace should be delivered by the existing coalition.

In view of all the foregoing, it is increasingly urgent to determine whether and how an adjustment can be made with Japan different from that which has been described as inescapable for Germany. Specifically, this writer challenges the idea that the destruction of Japan is prerequisite for the peace in the Far East as the destruction of Germany is a prerequisite for the peace of Europe. It is submitted and urged that an adjustment can be made with the Japanese, providing we are content not only to avoid destroying but to use constructively the institution of the Emperor.

If this policy be integrated with the safeguards, then even the ideological enemies of Japanese economic feudalism should be satisfied that democratic principles will not be compromised away. The safeguards and prerequisites of the recommended reorientation of political strategy are in the main these: (1) total evacuation of conquered areas and total disarmament of the Japanese armed forces; (2) military and political control and direction by Allied representatives over Japan and her administrative-governmental system; (3) radical reform of the economic feudalism; (4) separation of Church and State in respect to Shintoism; and (5) fostering guidance and aid to China, lest the political and economic consequences of the Far Eastern War prove the ideal explosive and exploitative material for an aggrandizing Russia and a resurgent Japan.

Exhibit 2 to Chapter II

From report by Dr. Vannevar Bush, under the title Science - The Endless Frontier, to the President, July 1945, p. vii -

Letter from President Roosevelt to Dr. Vannevar Bush

The White House,
Washington,
November 17, 1944

Dear Dr. Bush:

The Office of Scientific Research and Development, of which you are the Director, represents a unique experiment of team-work and cooperation in coordinating scientific research and in applying existing scientific knowledge to the solution of the technical problems paramount in war. Its work has been conducted in the utmost secrecy and carried on without public recognition of any kind; out its tangible results can be found in communiques coming in from the battlefronts all over the world. Some day the full story of its activities can be told.

There is, however, no reason why the lessons to be found in this experiment cannot be profitably employed in times of peace. The information, the techniques, and the research experience developed by the Office of Scientific Research and Development and by the thousands of scientists in the universities and in private industry, should be used in the days of peace ahead for the improvement of the national health, the creation of new enterprises, bringing new jobs, and the betterment of the national standard of living.

It is with that objective in mind that I would like to have your recommendations on the following major points:

First: What can be done, consistent with military security, and with the prior approval of the military authorities to make known to the world as soon as possible the contributions which have been made during our war effort to scientific knowledge?

The diffusion of such knowledge should help us stimulate new enterprises, provide jobs for our returning servicemen and other workers, and make possible great strides for the improvement of the national well-being.

Second: With particular reference to the war of science against disease, what could be done now to organize the program for continuing in the future the work which has been done in medicine and related sciences?

The fact that the annual deaths in this country from one or two diseases alone are far in excess of the total number of lives lost by us in battle during this war should make us conscious of the duty we owe future generations.

Third: What can the Government do now and in the future to aid research activities by public and private organizations? The proper roles of public and private research, and their interrelation, should be carefully considered.

1 Fourth: Can an effective program be proposed for discovering and developing scientific talent in American youth so that the continuing future of scientific research in this country may be assured on a level comparable to what has been done during the war?

✓ * New frontiers of the mind are before us and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life.

I hope that, after such consultations as you may deem advisable with your associates and others, you can let me have your considered judgment on these matters as soon as convenient - reporting on each when you are ready, rather than waiting for completion of yours studies on all.

Very sincerely yours,

* The inseting accorded to this paragraph is for emphasizing its use by Dr. Bush as the epigraph, on a separate page, ix, for his whole report to the President under the title Science - The Endless Frontier, July, 1945.

Exhibit 3 to Chapter II

Response to President Roosevelt's Letter of November 17, 1944 by Dr. Vannevar Bush, as Opening to Full Report, With Sub-Reports, Under Title Science - The Endless Frontier, July, 1945*

Director of the Office of Scientific Research and Development
1530 P Street, N. W.
Washington, D. C.

July 5, 1945

Dear Mr. President:

In a letter dated November 17, 1944, President Roosevelt requested my recommendations on the following points:

((The points are set forth as (1) - (4) in the words of the initial paragraphs (without the extra comments) from the original letter of the President on November 17, 1944.))

It is clear from President Roosevelt's letter that in speaking of science he had in mind the natural sciences, including biology and medicine.

In seeking answers I have had the assistance of distinguished committees specially qualified to advise in respect to these subjects. They have had many meetings and have submitted formal reports ... Although the report which I submit herewith is my own, the facts, conclusions, and recommendations are based on the findings of the committees which I have studied.

.....

In proposing a single mechanism for implementing the recommendations, I have departed somewhat from the recommendations of the committees, but I have since been assured that the plan I am proposing is fully acceptable to the committee members.

** The pioneer spirit is still vigorous within this nation. Science offers a largely unexplored hinterland for the pioneer who has the tools for his task. The rewards of such exploration, both for the Nation and the individual, are great. Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, and to cultural progress.

Respectfully yours,

(signed) Vannevar Bush

* Though that response by Dr. Bush was dated July 5, 1945, or months after the death of President Roosevelt, and thus the document was directed to President Truman, the whole content of the letter is keyed throughout to President Roosevelt's concepts and objectives and does not appear to refer to any possible intervened exchange of views with the successor-President.

** The inseting accorded to this paragraph is not merely for its relative importance within the letter, but for the harmonics between it and the corresponding asterisked paragraph in President Roosevelt's letter. Both provide resonance for a fundamental theme that was struck by the original proponent of the Atomic Project in the conferences through 1939 until late-summer 1941. That theme, coordinate with the needs of National Defense as objectives for the Atomic Project, revolved around deflecting President Roosevelt from the then academically fashionable theory of "economic maturity and stagnation" and converting him to the re-setting of the U.S. polity and economy into the exploration and development of "Science - The Endless Frontier."

Highlights from the Summary of the Report

1. As to the first point, dealing with health and life, it is affirmed that progress in the war against disease through scientific knowledge and new products has markedly reduced the loss of life from 14.1 to the thousand to .6 to the thousand in this war. It is noted further that in the last forty years, or from around the beginning of the century, life expectancy has increased from 49 to 65 years, or about a third. This has been largely from the reduction of the death rate of infants and children. The recommendation of Dr. Bush is that the Government should extend financial support to basic medical research in our medical schools.

2. National Security: The bitter and dangerous battle against the U-boat was a battle of science techniques and "our margin of success was dangerously small. The new eyes which radar has supplied can sometimes be blinded by new scientific developments." That apparently was the case with the V-2. That danger was overcome by our capturing the launching sites.

** "We cannot again rely on our Allies to hold off the enemy while we struggle to catch up."**

3. Postwar Welfare:

"One of our hopes is that after the war there will be full employment. To reach that goal the full creative and productive energies of the American people must be released ... But new products and processes are not born full-grown. They are founded on new principles and new concepts, which in turn result from basic scientific research. Basic science research is science capital.

** "Moreover, we can no longer depend upon Europe as a major source of this scientific capital. Clearly, more and better scientific research is essential to the achievement of our goal of full employment. **

"First, we must have plenty of men and women trained in science. Second, we must strengthen the centers of basic research, which are principally colleges, universities, and research institutions."

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** Asterisks and indentation indicate italics for passages thus marked.

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** "The expenditures for scientific research by industry and Government increased from \$140 million in 1930 to \$309 million in 1940. Those for the colleges and universities increased from \$720,000 to \$31 million, while those for research institutes declined from \$5.2 million to \$4.5 million.

"For science to serve as a powerful factor in our national welfare, applied research both in Government and industry must be vigorous. For the governmental agencies a Permanent Science Advisory Board is recommended.

"Incentives to industry to conduct research (a) by clarification of present uncertainties in Internal Revenue deductibility for Research and Development expenditures as current charges against net income and (b) by strengthening the patent system so as to eliminate uncertainties, which now bear heavily on small industry and so as to prevent abuses which reflect discredit upon a basically sound system.

"We must renew our scientific talent. The deficit of scientific and technical students from the war is about 150,000. In advanced degrees the candidates' deficit will by 1955 aggregate 17,000."

CHAPTER III

Protracted Nascence of Atomic Project Under U.S. Governmental Sponsorship and Direction, in the Extending and Deepening Concerns Over Imminence and Engulfment World War II as the Survival Struggle of and by Western Civilization.

For our tuning up to an understanding of the pre-war situation that rendered possible the U.S. Government's even entertaining, let alone effectuating, the up to then so unprecedented an idea as sponsoring Atomic Research and producing an Atomic Weapon, it is necessary to recapture the accumulating consciousness through that traumatic decade from 1929 to 1939, characterized by economic reversal and declassification in power and prestige by Western Europe and the U.S. over-against encroachments and aggrandizements by the anti-democratic powers of Nazi Germany, Fascist Italy and Militarist Japan.

In the aftermath of the Great War 1914-1918, the elements of leadership down to the general public among the victorious powers, that constituted the then democratic world, resumed and carried on their national life on that legacy from the Eighteenth Century that history was permeated and propelled by an automatic, interminable and invincible progress. It was in the interlude between the American and the French Revolutions that Edward Gibbon, as epilogue to his portrayal of the decline and fall of the Roman Empire, featured the emerged modern Western Society as impelled by progress;

"Since the first discovery of the arts, war, commerce, and religious zeal, have diffused...those inestimable gifts: they have ^{been} successively propagated; they can never be lost. We may, therefore, acquiesce in the

pleasing conclusion that every age of the world has increased, and still increases, the real wealth, the happiness, the knowledge, and perhaps the virtue of the human race." (1)

What to Gibbon was a working hypothesis became in the century after the American and French Revolutions a popular dogmatic belief and accepted valid generalization by professional historians from History. Thus, the British historian, J.B. Bury, who, as noted, reissued Gibbon with documentary elaboration, brought out immediately after the Great War, his purported demonstration for "The Idea of Progress: An Inquiry into its Origin and Growth" (1920). Indeed, even in the depths of our Great Depression, the Centennial Celebration at Chicago, having been dramatized as a 'Century of Progress' prompted a reissue of Bury's book in 1932. That reissue carried an introduction by the rather radical dean of professional historians, Charles A. Beard, who though he embellished the original theses took no cognizance of the great and grave changes that ensued since the publication of that book on progress in 1920.

But, from the onset of the Great Depression in 1929, into and through the decade of the Thirties, the main countries and exemplars of Western Civilization were undergoing continuous deterioration, as if already a structured entropy of progress, and were experiencing in the domains and dimensions of cultural and social life that "Crisis of the Spirit" that had been so prophetically and concernedly expressed by Paul Valéry at the War's end,

(1) Edward Gibbon "The History of the Decline and Fall of the Roman Empire", Chapter XXXVIII, concluding 'General Observations on the Fall of the Roman Empire in the West', in J.B. Bury's elaborately annotated edition - seven volumes (1909-14) Volume IV, 1910, at page 181.

whom we cited in the overture to this Study. The interplay between cultural and psychological changes and the moments of disintegration in economic and political power by the West led to socially mounting fears that the Western System and its basic concepts and methods were threatened by breakdown and loss of faith in the System's capacity to function as a "going concern".

Yet, under the carried-over rights and resources for free and independent science in and outside the universities as a progressing legacy from the Ages of Enlightenment, -- the interlude between the two Great Wars witnessed rapid efflorescence in fundamental Physics and Atomic Research. Indeed, the year that marked the depth of the Great Depression, 1932, became according to A.S. Eve, the Annus Mirabilis of Atomic Physics. It was signalized by the discoveries in 1932 by Cockroft, Walton and Chadwick in England, and Lawrence, Urey and C.D. Anderson in the United States. In rapid sequence came the work of Fermi in Italy in 1934 and in the same year, Irene Currie and Frederic Joliot-Curie in France. Subsequently, the remifying and converging labors of other European and American physicists culminated in that fulfillment of Atomic Fission that had been missed in 1934 and that was attained at end of 1938 by Hahn-Strassmann in Germany, with requisite clarifying interpretations by Meitner-Frisch and Bohr.

Then and thence the larger implications for and potential applications to National Defense induced a social scientist in collaboration with physicists to the enlistment of initial and prolonged concern by the President of the United States, out of which was inaugurated for the first time in history a symbiosis of U.S.

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Government and Science during World War II for prosecution of research for climactic applied Science.

The thus described counterphase movements, as represented by the retrogression of Civilization's Political Order and the maintained progression by Science -- and the impact on both by the Crisis of Civilization from the Totalitarian Powers at the outbreak of World War II -- constitute the historically variegated reference-frame of the Atomic Project. Out of the confluence of the depicted forces in that reference-frame there came the concerted labors of Political Leadership, Experimental Science and American Enterprise and Management, which together effectuated the Atomic Bomb for accelerated victory.

Now that special Science Progress came to act upon the special retrogression of the modern political and economic system in its accrued great crisis constitutes the crux of the origination of the Atomic Project.

Against the above-presented not only background to but also proscenium of ensuing history, the attributions by journalists and by the technological communications media of magical powers to certain personal interventions -- starting with this author and associates -- ⁱⁿ ~~an~~ atomized moment in the flux of history is not only false history but requires "de-mythologizing" as pre-condition to receptivity for comprehension of the veridical history.

Moreover, the time-extended struggle from beginning 1939 to end 1941 -- instead of the fictionalized single submission to the President in Autumn 1939 -- represented the origination of the Atomic Project. It was followed by the effectuation of the Weapon. Then, towards the Finale of the applied Science the original aims of the Atomic Project for Defense and Peace became transformed into another and larger Project

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through the assignment in November 1944 by the President to the Director of the War's all-embracing Research and Development of proposals for progressing with "Science--The Endless Frontier," which in the course of the post-war to date has, as a legacy from President Roosevelt, become the continuing Scientification of the Innovative U.S. Economy and Society.

CHAPTER III

On Science's Target-Role in the War-Prelude Years as Manifested in the Persecution of Scientists and Attacks on Science's Independent Existence by the Counter-Civilization Aggressor-Power From 1933 On

The elicited contrast in the preceding Parts between the sustained progress of physical science and the retrogression in the political and economic power of the Western World, - that phase and dimension of historic contrast were attended by the phase and dimension of complementarity and common threats in the wake of accession of Hitler to power over Germany and the ensuing effectuation of Nazi policies towards human freedom and science and the Nazi pursuit of world hegemony keyed into counter-civilization. It is the correlative phase and the coordinate dimension in the experience by the Scientific Community in Germany and in dominated areas and the portent of the engulfing plight from the growth of Nazi power that are requisite for the understanding of the original conversion of President Roosevelt to and his subsequent persistence in fostering the Atomic Project, notwithstanding the pressures upon him from 1939 through 1941 to let already articulated programs of technological defense absorb the totality of mobilizable resources of materials and professional manpower.

A.

Not only do we have to go beyond the fictional and mythical causation for the Atomic Project as popularized by contemporary press and communications media, but we have to transcend the addiction of the professional historians to unidimensional sequences of events and actions of individuals. For as was discerned and expressed by that practitioner and philosopher of science, Alfred North Whitehead, just before World War II:

"Thus the study of history as mere sequence wears itself out. It is a make-belief ... We (must) seek that thread of coordination derived from the special forms of importance prevalent in the respective epochs ... Ideals (and

ideas) lie beyond matter-of-fact, and yet provide the colour of its development ... (lest) the concrete world slip through the meshes of (even) the scientific net."*

Moreover, since discursive discourse by professional historians is so habituated to chronological sequences, it is relatively rare to move back and forth between the presumed horizontal level of time-progression and the intersecting dimension of levels of significance and forward import that in great crises of history preoccupy great leaders, as has been so saliently illustrated by President Roosevelt and Prime Minister Churchill throughout the Second World War.

Indeed, over the whole gamut from the primary submission of the idea of an Atomic Project through the whole three-year struggle for its programmatic effectuation, the close advisor and then the agents of the President were moved by common ideas and ideals out of variably shared conviction as to the transhistorical rightness of the Atomic Project as an instrument of victory against the counter-civilization aggressor and as to further rightness of the novel role of fostered free science in the postwar for what was designated at the end of the prior chapter as the Scientification of the Innovative U.S. Economy and Society.

Moreover, that transformed internal U.S. polity and economy of the postwar was integrated with the fostering of European Reconstruction through the Marshall Plan - as an equivalence-continuation of the Lend Lease to the Allies during the war, a device first proposed to the President at the end of 1940 by this original proponent of the Atomic Project. That postwar economic renaissance of Europe was in turn coordinated with the American invest-

*Modes of Thought, Cambridge Press, 1938, p. 25; condensed and clarified with indicated inserted words

ments mediated by the transposed applied science from the science-oriented U.S. corporate economy. The consequential economic prosperity and social welfare of Europe and the U.S. for a transyclical time-span of over a decade to date has and continues to represent a mutation in economic history for the re-attained ecumenical Western Civilization.

Accordingly, the initially struck theme of this Part revolves around the opening exposure of the community of researchers and scholars in free science and free learning to ideological attacks and the physical processes of deprivation, persecution and expulsion. All this was at the hands of the power-

forces that became the master over Germany in 1933. From their power-base and through technological ^{SC} armament (or Wehrwissenschaft), the Nazi leader and system effected cumulative aggrandizement throughout the Thirties, which culminated in total war against not only the originally victorious powers in World War I, but also against the whole complex of the cultural, religious and scientific systems of values, rights and duties that represented the heritage and progression of Western Civilization.

B.

is master and follower
From the start of the exercise of power the Nazi tyrannical system proceeded to impose on its own population its ideologies of racism and anti-^{to} freedom and totally subservient conformity to the system of delegated authority from the charismatic leader to the total submergence of independent thought, inquiry and communication. While the persecution and initially optable exile applied to the sectors of the population not conforming to the rigidly formulated categories of race-derivation and/or affected by prior association with free political concepts and culture, the groups on whom the deprivation of rights of professional pursuits were most telescoped were the scientists and scholars, especially in physics, by reason of imputed contamination from the prominent non-Aryan exponents of the new physics. For such researchers and scholars the outstandingly accessible haven of refuge became Great Britain. And by a unique poetic propriety in the history of culture, the organization for the assistance of the refugee-scientists and scholars was headed up by Lord Rutherford, that pathfinder in atomic research whom A. S. Eddington - the Cambridge astronomer and experimental confirmer of Einstein's Relativity Theory - had characterized as the introducer of "the greatest change in our ideas of matter since the time of Democritus."

At the organization mass-meeting at Albert Hall, Lord Rutherford announced formation of "The Academic Assistance Council," aimed to supply posts for the many hundreds of displaced university teachers and researchers. The meeting was also addressed by Dr. Albert Einstein, in English, on the main theme of "Science and Civilization," with particular reference to mankind's gifts and needs of liberty:

"Today the questions which concern us are: How can we save mankind and its spiritual acquisitions, of which we are heirs? How can we save Europe from a new disaster ... It is only men who are free who create the inventions and intellectual works which to us moderns make life worth while. Men in their distress begin to think about the failure of economic practice ... Only through perils and upheavals can nations be brought to further developments. May the present upheaval lead to a better world."

Of the thus established Council of Assistance Lord Rutherford was President; he issued appeals in the press for funds in the ensuing year, and used his influence with university and research institutions for the permanent placement of a large part and for temporary work with research access for the remainder of the about one and a half thousand that by 1937 had come to England. In the report for the year 1936 on the designated "Scholar Exiles," Lord Rutherford declared that the then accrual of thirteen hundred scholars represented one sixth of the universities' staff of Germany. He also noted that the aggravation of conditions for and oppressive measures against scholars in Germany came to include banning of any acceptance of invitations to appear before learned societies or to universities outside, - which denial was ^{to be} /disguised by required transmittal of excuses "on grounds of ill health." Moreover, "scholars have been denied access to public libraries, so that they cannot even continue their research privately."

C.

Turning from the active and increasing persecution of the human carriers of science-progress to the restraints by the Nazi system on the functioning of science within Germany through the remaining scientists, it is noteworthy that the year 1937, which witnessed the formation of the triple Axis with Italy and Japan, also witnessed agitation by prominent Nazi officials and figures for detachment of Nazi science-work from international contacts, by reason of the continuance in the outside Free World of adherence to freedom, rejection of racism, and attachment to the historic traditions and exponents of freedom of thought. Thus the German periodical Das Schwarze Korps (The Black Corps) of July 15, 1937 inveighed against (a) "exchange of experience" with other scientists and (b) the whole "doctrine of the internationality of science." This the author of that article declared was 'most clearly recognizable in the field of physics and with its most significant representative being Professor Einstein.'⁴ Hence the purging from that spirit was stated to be 'our most urgent task.' Again, it was stressed, that such purging was needed lest, through that spirit and through the outside connections, there could develop a 'regaining of a significant influence on all spheres of national life.' Instead of such links and such pursuits, the academicians and researchers remaining within Germany ought to be pressing for 'decisive achievements in the fields of heredity, race-hygiene and public health.' Moreover, the scientific and other journals were criticized for publishing material to the extent of about half of the over two thousand published 'from foreign authors' and from non-German orientation.

D.

The foregoing disclosure of the embarked on campaign by the Nazi system from mid-1937 on for restricting contacts with the Free World's science research requires further development, for its bearings on (a) emergence of atomic fission and its explication within the Free World and thence to the experimenters in Germany, and (b) the burgeoning research within the Free World in 1939 that led up to the presentation by a friend and advisor of President Roosevelt of the Atomic Project as a unique opportunity and urgency in the conjoint histories of Science and of the Politics of Civilization. In this connection, it is appropriate to recall this writer's testimony before the U.S. Senate Committee on Atomic Energy at end of November 1945 regarding the lectures on atomic physics at Cambridge University by Lord Rutherford and F. W. Aston during the Lent terms 1937-1938 and the closing prophecy by F. W. Aston that "one day man will release and control atomic energy's almost infinite power." The concomitant following of the subject by this writer in the British scientific press made him aware that the preeminent scientific weekly journal Nature was banned by the Nazis and ordered "excluded from general use in scientific libraries." The timing in later 1937 of the ban was not precisely stated beyond the report of the German Ministry of Education's action "a couple of months ago" (Issue of January 22nd, 1938, page 151). The basis of the banning was that "articles have often been published in the scientific journal Nature containing unprecedented and base attacks against German science and the National Socialistic State." The banning applied to "the libraries of the universities, colleges, institutes, and research departments." Moreover, it was stated that "secret use and restricted access to the journal" were subject to previously issued decrees from September 1934 to December 1936.

In the reply comment on that order Nature of course disclaimed any

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prior attacks on "German contributions in scientific journals." But it also declared that "we should be false to the traditions of science if we failed to condemn any influence which would make scientific research subservient to political or theological domination." It concluded "with regret that the penalty involved in the withdrawal Nature from libraries and other institutions will be felt more by some of our readers in Germany than by ourselves."

As the terms of the ban appear to include clearly the Kaiser Wilhelm Institute of Chemistry (in Berlin-Dahlem), in which Professors O. Hahn and F. Strassmann carried on their atomic experiments, it must have been due to either granted exceptions or delays and complications in establishing enforcement machinery. The latter is the more plausible reason, on the basis of information that was conveyed to this writer as late as post-Munich by Lord Stamp on return from having visited Germany while the so-called Munich Agreement with Britain was regarded as in force. The impression received by him, as reported to this author (who had been close to him since 1931) was that even a visited successor to Schacht in the position of President of the Reichsbank told him that masses of regulations had remained in suspense, - yet once terms of enforcement were received their effectiveness was retroactive inclusive of penalties, whose imposition would depend upon the caprice of enforcing officials.

With respect to the experiment by Hahn and Strassmann that precipitated what they called the 'trans-uranic element', Hahn was perplexed by the result - to wit, the alleged forming of barium from uranium. He wrote to his previously equal collaborator Prof. Lise Meitner, who had to escape from Berlin to Sweden after Hitler's occupation of Austria. Not only did Lise Meitner and her nephew Otto Frisch provide a correct explanation of atomic fission but they sent their results for publication in Nature on January 16th, 1939. The experimentally checked

interpretation of theirs that atomic fission occurred appeared in the issue of Nature of February 11, 1939 with a follow-up on the basis of a further experiment.

It was the rough notes made by Frisch prior to final communication to Nature that Niels Bohr took with him to the United States on his trip by steamer to New York, arriving on January 16th, 1939, that became the basis of his revelatory exposition to the community of scientists and other members of the Institute of Advanced Study at Princeton, - from whom this writer received a report as discussed later herein. Now the issue of Nature of February 11th also contained an account of the experiment and ^{the German} article by Hahn and Strassmann, which concluded on a pervasive question mark. The companion publication of the Meitner-Frisch letter in that issue of February 11th specifically answered the question and cleared up the doubt by declaring the result to have been "a new type of nuclear reaction", to which Frisch first used the term 'fission' on analogy borrowed from biology. The supplementary and confirmatory letter of Professor Bohr from the Institute at Princeton dated January 20th appeared in the issue of February 25th. Another communication from Meitner-Frisch was published in the issue of March 18, 1939 and was entitled "Products of the Fission of Uranium Nucleus." And the same issue contained a joint letter from Halban Joliot, and Kowarski from Paris entitled "Liberation of Neutrons in the Nuclear Explosion of Uranium", - which may be regarded as co-discovery.

Against the background of the previously set forth Nazi interdict on the reading of Nature by members of the scientific institutes, going back to the closing months of 1937, it is inescapable that to slowness and laxity of enforcement or to special exception for Hahn must be attributed the availability of international clearing-up of the uncertainties that Hahn expressed at the end of

his epochal paper. And coordinately, his very communication with Meitner might have been considered a breach of at any rate the spirit of the proprieties affecting conformists to the Nazi system, that for over a year had looked with disapproval on what, as cited above from an important Nazi organ as "amounting to exchange of experience" and indulging in the "internationality of science."

E.

The linkage of this study with the Commemoration of the achievement of the nuclear chain reaction by Dr. Enrico Fermi and associates, inclusive of the University of Chicago, provides the opportunity for illuminating the role in the complex enterprise called "Origination of the Atomic Project" that was played by the reorientation of the Scientific Community itself towards what was at stake in the threats of war in the progressing Thirties and in the embarking on war in the autumn of 1939. In divergence from and negation of the popular myth about the way the President's backing was secured, a mere brief reflection on the overwhelming problems that concerned him in October 1939 upon marginally securing modification of the Neutrality Act should suffice to convince anyone at all familiar with the contemporary history that against a background of the opposition by the Armed Services, the President could not have entertained the novel idea that was presented.

What led to receptivity was that he had been prepared - as far back as the report given him of the Lord Rutherford and F. W. Aston's Lectures, as documented in this writer's Senate testimony end-1945 - for the larger and deeper significance for the nation and civilization of not only protection against Nazi pursuit of the potential applied new science but the manifold potentials for U. S. leadership in the new basic physics and its applications for defense shifting into war

as he and the proponent were certain of and for the novel stimuli to postwar prosperity from the above designated Scientification of the U. S. # Coordinately and confluenty there had to be preparedness by the Scientific Community and the specific researchers on whom we are putting the searchlight herein to abandon their past aloofness from international politics and to act on a sense of common cause / ^{with} the bodies politic and social in all civilized nations. In that perspective it has turned out to have been a providential frustration of the Nazi system of closing-in on international science that Professor Enrico Fermi met with Professor Niels Bohr just after Niels Bohr himself awaredly became a target of Nazi discrimination for his advocacy against the Nazi tribalistic myths of racialism and anti-internationalism in scientific and cultural interchange. # It was in August 1938 that Niels Bohr had delivered an address before the International Congress of Antropological Sciences that was held in that old Danish castle of Elsinore that Shakespeare had made the setting for Hamlet. Having set as his subject "Natural Philosophy and Human Culture", he challenged unscientific and anti-humanist theories of racial superiority and racial persecution and pleaded for harmony and free interchange between races peoples and cultures under his " principle of complementarity for the advancement of human civilization." The major themes, as excerpted from that Address, are as follows:

"Using the word much as it is used, in atomic physics, to characterize the relationship between experiences obtained by different experimental arrangements and capable of visualization only by mutually exclusive ideas, we may truly say that different human cultures are complementary to each other. Indeed each such culture represents a harmonious balance of traditional conventions by means of which latent potentialities of human life can unfold themselves in a way which reveals to us new aspects of its unlimited richness and variety. ... The importance in this respect of the mixing of populations through emigration or conquest for the advancement of human civilization need scarcely be recalled. It is indeed, perhaps the greatest prospect

of humanistic studies, to contribute through an increasing knowledge of the history of cultural development to that gradual removal of prejudices which is the common aim of all science." (Published half a year later in "Nature," February 18, 1939, pages 268-272, at 271)

Again though that Address was not published for another half year - in that international scientific journal Nature, wherein this writer read it at the time, - echoes of it had reached the Nazi censorship. And so on the very following month of September 1938 all German alumni of Dr. Bohr's Institute of Theoretical Physics at Copenhagen absented themselves from the Annual Seminar. By fortunate contrast, Dr. Enrico Fermi attended. The advance intimation given by Bohr that Dr. Fermi was under consideration for the Nobel Prize in Physics evoked inquiry of and declaration by Dr. Fermi of his long-standing opposition to Fascism and desire for liberation from the encroaching threat to his family from Fascism's imminent adoption of the Nuremburg Laws. He therefore gladly accepted from Prof. Bohr the suggestion that in the event of the award and the ensuing attendance at the Nobel Prize ceremonies in Stockholm, the Fermi family could effectuate their exodus from Italy. Then under the guise of attendance at the ceremonies, the Fermis left Italy, and after Stockholm visited with Dr. Bohr in Copenhagen. Thence they sailed for the U.S., for a stretch at Columbia University and then at the University of Chicago.* Thus after the lapse of a month since their stay at Copenhagen, Dr. Enrico and Mrs. Laura Fermi welcomed their host on his arrival in New York aboard the DROTTHINGHOLM on January 16, 1939.

On that arrival they noticed Dr. Bohr's grave mien (As came to be reported to this writer, on his visit to the Institute of Advanced Study, by the new Director, Dr. Aydelotte and Prof. Walter Stewart of the Institute's Economic

*Note: Based on R. Moore's "Niels Bohr" 1966, pages 217-220, with the assistance of Prof. Aage Bohr and the Copenhagen Institute Staff.

Group and Trustees of the Rockefeller Foundation). He explained the cause to them (an explanation then convey^{ed}/to and recorded by this writer and thus to President Roosevelt). He was gravely concerned over (a) threat of war in Europe and (b) the meaning of and sequel to the epochal fission effected at the end of 1938 by Dr. Otto Hahn and Fritz Strassmann, and interpreted by Dr. Bohr's close friends Prof. Lise Meitner and her nephew Otto R. Frisch!

F

Progressing Reorientation by the Scientific Communities
in Britain and Then in the U.S. from the mid-Thirties
on to Collective Opposition to Nazi Ideology and Treat-
ment of Scientists and Science

This culminative section of the instant chapter "On Science's Target-Role in the War-Prelude Years" has been accorded a title of its own, not only because it rounds out the main themes but also because it highlights that re-orientation by scientists on the role of science in society which - as noted in the preceding section - played an important part in the time-extended origination of the Atomic Project and both thereby and thereafter in the postwar scientification of the U.S. The opening section of this very chapter recaptured their perceptiveness and their responsiveness to the Nazi danger to science by Lord Rutherford as the representative atomic experimenter and Dr. Albert Einstein as the scientific luminary and humanist of that whole interwar epoch. Yet the representative national organizations of scientists in Britain and in the U.S. - the former closer to the Nazi threat than the latter - concerned themselves initially with only the problem of assistance to the exiled scientists. It was not until the Nazi regime extended its domain - that is after the military re-occupation of the Rhineland - that scientists in representative organs and later professional organizations began to speak

out on the requirements presented in the adjustment by scientists to the political as well as human and cultural issues involved in Nazi expansion.

The realization and advocacy of a new orientation by scientists as professionals and as citizens found expression in a leader (or editorial as we say), as the British say, in the British journal Nature in the summer of 1936. From that leader entitled "Science and Citizenship" we submit the following passages:

"During the past generation, scientific men have generally adopted an attitude of indifference to politics, and active interest or participation in political controversy have been discouraged by leaders of British science ... to justify a policy of aloofness

"Of late there have been signs that representative leaders of the scientific movement realize a new danger in repudiating the responsibility of the scientific worker as citizen ... For various reasons - the betrayal of scientific freedom in present-day Germany, the frustration of medical progress by large scale unemployment ... and the shadow of a war which may destroy civilization - there is a new awareness of social responsibility among the rising generation of scientific workers

"In the formative periods of British science, the man of science had been keenly alive to the social implications of his work. The "invisible college" was formed by men inspired as Spratt tells us, by Bacon's eloquent plea: "The true and lawful goal of science is that human life be endowed with new power and inventions." Boyle himself reiterated the common objective that "goods of mankind may be much increased by naturalists' insight into the trades"

"The popular appeal made by the proposal for a moratorium on inventions is a real danger which now threatens science progress. The undercurrent of press criticism which places the blame for unemployment on a supposedly too rapid growth of technical knowledge is reinforced by fear of the vast disruptive potentialities which science has conferred on warfare. To reflect that the responsibility lies with the Government may reassure the conscience of the individual man of science. One may well doubt whether such reflections will satisfy the plain man or save science from the wreckage if the events shape as Mr. Wells forecasts. Brilliant culture have been eclipsed in the past and followed by ages of darkness. This may be the fate of our own social culture. If so, social aloofness may prove to have been the betrayal of the scientific movement." (Issue May 30, 1936 pages 883-4; added italics)

The full text included a reference to a letter entitled "Scientific Workers and War" that was published in the earlier issue May 16, 1936. That letter signed by twenty-two Cambridge University men underlined the very need for sustained discussion and reflection, since it concluded with the curious but often recurrent thesis by pacifists among scientists that war-boycott ("war would be impossible if all scientific workers opposed it") by a presumed strategic sector of society is feasible and that it has the slightest relevance to totalitarian systems of the right or the left.

The italicized part touches on an issue that affected Britain ahead of us, namely the challenge to internal support for science on the misedconomics that began to be fashionable under the slogan of technological unemployment. The very next meeting of the British Association for the Advancement of Science at Blackpool was opened by a Presidential Address on "The Impact of Science Upon Society" by that prominent practical economist and public figure Sir Josiah Stamp. While Sir Josiah, afterwards Lord Stamp, (a close friend through the Thirties of the present writer) was critical of that type of political economy, even he by intimating scope for "a balance of innovation and population growth" paid insufficient attention to the causal connection between the chronic unemployment of the Thirties and the deterioration by the Democratic Countries over that whole interwar score years in the Coordination of their National Security and Prestige and the attendant sustainable rates of worldwide economic expansion, in comparison with what had obtained in the generation prior to World War I. It was the later conversion of and adherence by President Roosevelt to the just defined countertheses, as amplified later, that led him to remain steadfast in requiring the Atomic Project of the 'Doubting Thomases' in 1940 and 1941 among the governmental scientific advisory organs on the feasibility of nuclear chain reaction and the Atomic Project.

Returning to the growing acceptance of the new orientation by

scientists towards an involvement in countering Nazi totalitarianism, it was in October 1937 that the British science-journalist Mr. Ritchie Calder, in an open letter, proposed a Magna Carta along with affiliation with the American Association for the cause of international recognition of and compliance with the precepts of science freedom and non-discrimination. His proposals in the American and the British press did influence and give impetus to a pronouncement by the American Association for the Advancement of Science that met December 30, 1937 at Indianapolis. The Association Council endorsed the following resolution:

"Whereas, science and its applications are not only transforming the physical and mental environment of men, but are adding greatly to the complexities of the social, economic and political relations among them; and

"Whereas, science is wholly independent of national boundaries and races and creeds and can flourish permanently only where there is peace and intellectual freedom: now

"Therefore, Be it resolved by the council on this thirtieth day of December 1937, that the American Association for the Advancement of Science makes as one of its objectives an examination of the profound effects of science upon society; and that the Association extends to its prototype, the British Association for the Advancement of Science, and to all other scientific organizations with similar aims throughout the world, an invitation to cooperate ..."

At the same time the Association reaffirmed a resolution on intellectual freedom, originally presented by Dr. Robert A. Millikan and Prof. Henry Morris Russell as follows:

"The American Association for the Advancement of Science feels grave concern over persistent and threatening inroads upon intellectual freedom which have been made in recent times in many parts of the world.

"Our existing liberties have been won through ages of struggle and at enormous cost. If these are lost or seriously impaired there can be no hope of continuous progress in science, or justice in Government, of international or domestic peace, or even of lasting material well-being.

"We regard the suppression of independent thought and of its free expression as a major crime against civilization itself...

"We feel it our duty to denounce all such actions as intolerable forms of tyranny. There can be no compromise on this issue, for even the commonwealth of learning cannot endure 'half slave and half free'. By our life and training as scientists and by our heritage as Americans we must stand for freedom." ✓

Then in the aftermath of Munich and the beginning of 1939 American men-of-science issued a Manifesto on the relations of science to the then developments in the international political situation. It was signed by 1284 scientific workers including three Nobel Prize winners in Physics: Prof. Harold Urey of Columbia, Prof. R.A. Millikan of California Institute of Technology and Dr. Irving Langmuir of General Electric. The aim of the Manifesto was, broadly speaking, to demonstrate to and to urge upon all scientific workers the duty of showing to the people of the United States that the development in political theory and practice in and by the totalitarian States cuts at the root of these principles, and at the same time at the freedom of all mankind, and endangers the possibility of the advancement of man's well-being through science. It quoted from a recent resolution of the American Association for the Advancement of Science the following:

under
"Science is (wholly) independent of national boundaries and races and creeds, and can flourish only when there is peace and intellectual freedom."

It then concluded:

^ "If science is to continue to advance and spread more abundantly its benefits to all mankind, then the man of science has a moral obligation to fulfil. He must educate the people against the acceptance of all false and unscientific doctrines which appear before them in the guise of science, regardless of their origin."

Though retrospectively there might be those who would be tempted to undervalue the foregoing utterances because they were not linked to programs of action, the valid answer is that these utterances were in the midst of a rife controversy with supporters of the 1937 Neutrality Act then in force, notwithstanding urgent pleas by the President for revision, by placing the aggressors and resisters of aggression on a common footing to the obvious advantage of the Nazi and other aggressors against the defend-

ers of the whole system of freedom and the consequent later imperilment of the U.S. Therefore, the unqualified stand taken against neutrality and against isolationism contributed to the education and reorientation of mass political opinion.

a summary in direct effect
(Finally, for the large bodies of scientific professionals and the educated public generally) The cumulative-declarations were a sort of secular equivalent to the prayer in the Collect that ushers in the Advent Season: "Stiff up, O Lord, the wills of thy faithful people." They served to effect that re-direction of thought and will that did prepare and promote the enthusiastic response and dedicated labors by the hosts of scientists and assistants in the laboratories and plants that brought the Atomic Project to completion.

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CHAPTER IV

On Imperilment Science and Persecution of Scientists in Wake Nazi Domination Over Germany From 1933 On as Parallels to the Encroachments on the Power System of the Democratic Countries of Europe and the United States

The portrayal in the foregoing Chapters of the interlude between the two World Wars (1919-39) has been in terms of a contrast between the remarkable progress of the physical sciences, notably atomic research and the retrogression in military and economic power of the Free World, represented by the victors in World War I. But whereas for the larger part of that interlude - from the aftermath of victory, or 1919, through the Great Depression, or up to 1933 - the European power system and cultural order remained integrated, the advent of Hitler and the Nazi Party to domination over Germany marked an explosive break which not only inaugurated the above designated 'power-retrogression' by the democratic countries, but consisted at the outset in the mounting by the Nazi regime, in implementation of its ideology, of repressive measures against free science and persecution of scientists and scholars. The embarking by the Nazi system, immediately after power seizure in 1933, on cumulative repression of science and imposed expulsion of scientists through that period - which culminated with atomic fission, which was, curiously, effected in Germany - provided a political mise en scene, through the refugee scientists, as stimulators for and collaborators in the rapidly evolving atomic physics, with the scientific establishments in their new milieus.

The thus delineated human and political prelude to the Atomic Project replaces the distorted picture by the original publicism, which has unwittingly been accepted by even professional historical and scientific authors, in terms of unidimensional sequences of alternatively (a) dramatizable individuals and events or (b) the impersonal momentum of science-research as presumed history of

what induced President Roosevelt, through his close advisor, to embark on governmental entrepreneurship and responsibility for the Atomic Project. The now standardized conventional chronicles, by their ignorance of the larger and deeper perspectives, fall short of qualifying as history for the reasons that were discerned and expressed by that philosopher-scientist, Alfred North Whitehead, just before World War II:

"Thus the study of history as mere sequence wears itself out. It is a make-belief ... We ((must)) seek that thread of coordination derived from the special forms of importance prevalent in the respective epochs ... Ideals ((and ideas)) lie beyond matter-of-fact, and yet provide the colour of its development ... ((lest)) the concrete world slip through the meshes of ((even)) the scientific net."*

The application of the foregoing to our task is that only through the indicated perspectives, and with dimensions of significance and importance interacting with sequential chronology, can we appreciate and understand how the President and his advisor, in responding to requests for aid, brought about a new creation in the relationship between Federal Government and fostered research through organizing the research and technology of the atomic weapon for victory in World War II and the planning in the finale phase of what became in the postwar the scientification of the United States.

A.

As Nazism was spearheaded by charismatic leadership rooted in ideological and aggressive propaganda against the liberal and libertarian ideas that had shaped our Civilization since the Renaissance, its concepts and practices of racialism and insisted-on conformity were polarized not only on the processes

* Modes of Thought, Cambridge Press, 1938, p. 25; condensed and clarified with indicated inserted words.

of and adherence to democratic modes of life, but science and scholarship in the whole educational system and in the media of cultural communication. This entailed from the outset displacement from educational occupations and professional careers of all non-conformists and non-qualifiers, as laid down by its rigid criteria of racial origin, direct and indirect, and past affiliation with democratic thought and life. Thus, among the groups on whom the deprivation of rights was telescoped were members of the scientific as well as the cultural professions and particularly those in the physical sciences by reason of racial links and imputed contamination from the prominent non-Aryan pioneers and exponents of the new physics. The rapidly and thoroughly imposed persecution led to the flight out of Germany, and later out of the countries in the extending orbit of Nazi political power, by large numbers of eminent scientists and scholars into the remaining free countries.

The outstandingly accessible and welcoming haven of refuge for many of the exiled scientists and scholars was Great Britain. The organization established in 1933 assisting the refugee-scientists and scholars was headed up by Lord Rutherford, that pathfinder in experimental atomic research whom Professor A. S. Eddington, the Cambridge confirmer in World War I of Einstein's Relativity Theory, characterized as the author of "the greatest change in our ideas of matter since Democritus." At the public meeting that autumn at Albert Hall the Academic Assistance Council was announced by its chairman, Lord Rutherford, for developing posts for the hundreds of displaced university teachers and researchers. That meeting was also addressed by Dr. Albert Einstein on the theme of "Science and Civilization" as dependent on mankind's gifts and defense of liberty as follows:

"Today the questions which concern us are: How can we save mankind and its spiritual acquisitions, of which we are heirs? How can we save Europe from a new disaster ... It is only men who are free who create the inventions and intellectual works which to us moderns make life worth while. Men in their distress begin to think about the failure of economic practice ... Only through perils and upheavals can nations be brought to further developments. May the present upheaval lead to a better world."

The demands on the Council of Assistance kept on growing so that its President, Lord Rutherford, in his report for the year 1936 declared that by then thirteen hundred scholars representing one sixth of Germany's university staffs had come to England. By then, as he noted, oppressive measures against scholars in Germany banned any acceptance of invitations to appear before learned societies abroad and that they had been "even denied access to public libraries" for continuing their research privately.

The immediately ensuing year of 1937 - which witnessed the formation of the Triple Axis with Italy and Japan, - inaugurated agitation by Nazi officials and propagandists for detaching German scientists and science-research from international contexts with the Free World's pursuits of research on the grounds of feared influence from the adherents to freedom and their rejection of racism. Thus, the Nazi periodical Das Schwarze Korps of July 15, 1937 inveighed against (a) "exchange of experience" with the scientists in the Democracies and against (b) "the doctrine of the internationality of science." That article declared that these imputed dangers to Nazi theories were "most clearly recognizable in the field of physics, with its most significant representative being Professor Einstein."

B.

In keeping with the influence exerted by the individuals and organs of Nazi propaganda, the Nazi Government authorities imposed in late-1937 a ban on the preeminent scientific journal, the British weekly Nature, as reporter

and interpreter of accruing progress in scientific laboratory experiments and scientific thought. Due to the disrupting contacts between Germany and the outside world, that British scientific publication learned only at the beginning of 1938 "that a couple of months ago" it had been banned and ordered "excluded from general use in scientific libraries" including those "of the universities, colleges, institutes, and research departments." (issue of January 22, 1938, p. 151) The interdict encompassed "secret use and restricted access to the journal" as subject to the series of decrees from September 1934 to December 1936.

In this very connection it is noteworthy that the terms of the ban appeared to apply to the very scientists working and using the library of the very Institute, the Kaiser Wilhelm Institute of Chemistry (in Berlin-Dahlem) in which Professors Otto Hahn and Fritz Strassmann later in 1938 carried on their atomic experiments, that through the transformative interpretation by an enforced refugee co-experimenter, led to the appraisal of the results in Nature as the achievement of atomic fission! The anomalous maintenance of international science-contacts by the two research teammates of Professor Lise Meitner - forced into exile in Sweden after Hitler's takeover of Austria in the spring of 1938 - may have been due to a certain moderation in enforcement for favorably rated persons and institutions that obtained up to the early months of 1939, according to a contemporaneous judgment conveyed to this writer by his friend, Lord Stamp, who had been on an official mission to Germany in the sequel to the Munich Pact. This may account for Hahn's resort to direct inquiry of Professor Meitner for light on his perplexity over the alleged formation of barium from uranium and also for a transmittal - though that may have been by a still resident British correspondent - of a resumé of the experiment on the production of the so-called transuranic element in the Nazi-anathemized Nature publication in the issue of February 11, 1939.

The outstanding human instance of survival, in the second half of 1938, of links between scientists in Nazi Germany and scientists in the Democracies is represented by the facilitated exodus of Professor Enrico Fermi from the Italy that, after the Nazi takeover of Austria, began to enforce strictly the Nuremberg Laws. It was in August 1938 that Niels Bohr delivered an address before the International Congress of Anthropological Sciences at the Danish Castle of Elsinore, the setting for Hamlet. His subject, "Natural Philosophy and Human Culture," challenged the unscientific and antihumanist theories of racial superiority and persecution and underlined the need for harmony and free interchange between races and cultures in accordance with his "principle of complementarity for the advancement of human civilization":

"Using the word much as it is used, in atomic physics, to characterize the relationship between experiences obtained by different experimental arrangements and capable of visualization only by mutually exclusive ideas, we may truly say that different human cultures are complementary to each other. Indeed each such culture represents a harmonious balance of traditional conventions by means of which latent potentialities of human life can unfold themselves in a way which reveals to us new aspects of its unlimited richness and variety. ... The importance in this respect of the mixing of populations through emigration or conquest for the advancement of human civilization need scarcely be recalled. It is indeed, perhaps the greatest prospect of humanistic studies, to contribute through an increasing knowledge of the history of cultural development to that gradual removal of prejudices which is the common aim of all science." (Published half a year later in Nature, February 18, 1939, pp. 268-72 at 271)

Again, though that address was not published for another half year, echoes of it reached Nazi censorship. And so in the following month of September 1938 all German alumni of Dr. Bohr's Institute at Copenhagen absented themselves from the Annual Seminar. By fortunate contrast, Dr. Fermi attended. The advance intimation given by Bohr that he was under consideration for the Nobel Prize in Physics evoked Dr. Fermi's declaration of his long-standing opposition to Fascism

and his desire for liberation from the encroaching threat to his family from Italy's imminent adoption of the Nuremberg Laws. He therefore accepted Dr. Bohr's suggestion that, in the event of the Award and attendance at the Nobel ceremonies, the Fermi family could effectuate their exodus from Italy. After Stockholm, they visited with Dr. Bohr in Copenhagen and sailed for the United States at the end of 1938.*

A further consequence of the boycott that the Nazi system imposed upon Bohr's Institute in September 1938 was that when Niels Bohr arrived in New York on the Drottningholm on June 16, 1939, with the knowledge of the experiment that had been made towards the year-end by Otto Hahn and Fritz Strassmann, he was fearful of the import of such science leadership by Nazi Germany. Dr. and Mrs. Fermi welcomed their host of the prior month and, according to the book cited herein, they noticed his grave mien. It was on the very eve of his departure that Professor Otto Frisch (as reported in his recent contribution to the European book on Niels Bohr, His Life and Work) had reported to him on the inquiry that Otto Hahn had made of his former collaborator, Lise Meitner, and the discussion by Frisch with his aunt as to the real meaning of that experiment that so perplexed Otto Hahn. The conclusion reached by Meitner and Frisch was ^{that} the reaction was the very new achievement of atomic fission. Bohr, after taking from Frisch a brief resumé of their interpretation, urged Frisch that the duet should send their conjoint results promptly to Nature. Curiously, the extensive letter on "Disintegration of Uranium by Neutrons: A New Type of Nuclear Reaction" was dated January 16, 1939, or coincidentally with Bohr's arrival in the United States.

* Based on R. Moore's Niels Bohr, 1966, pp. 217-20, which was written with the assistance of Niels Bohr's son, Professor Aage Bohr, and the Staff of the Copenhagen Institute for Theoretical Physics.

Both the Fermis on meeting him, and later his hosts at the Princeton Institute for Advanced Study, were impressed by the gravity of his appearance and an attitude of anxiety. Anxious as he was in his initial contacts with physicists at Princeton to avoid disclosure ahead of publication of his knowledge of the very recent revolutionary scientific discovery, it was only through comments by an unwarned colleague who accompanied him that the burden of his secret came out. As this writer's close friends then at the Institute, - the new Director, Dr. Frank Aydelotte, and a faculty member, Professor Walter Stewart, also a Trustee of the Rockefeller Foundation - were concerned more with the international situation than science, he did convey to them, and they in turn conveyed to this friend of theirs, his fear of the imminence of Nazi resort to war in Europe and his worry about Nazi Germany as the locus of a revolutionary discovery that might have applicability to technological war, for which the Germans had already devised the new term of Wehrwissenschaft. While awaiting news from Copenhagen, and particularly from Dr. Frisch who had remained at his Institute, regarding publication of the conjoint letter, it ensued that in the midst of attendance, beginning with January 26th, at the Fifth Washington Conference on Theoretical Physics, the Director and a reporter of Science Service, who were covering the sessions, showed him an advance copy of the German scientific publication that contained the article by Mahn and Strassmann. Thus these members of Science Service released on January 28th to the dailies and magazines the remarkable news of "hope for releasing enormous stores of energy within the atom (in the order of two hundred million electron volts of energy) forty times the amount shot into it by a neutron." -- Thus while the physical scientists were acclaiming the remarkable experiment, the humanists and social scientists at the Institute were focusing their thought, and also that of this later-invited co-discussant, on the implications of Bohr's imparted anxieties about war and Nazi applications of science to tactics of Blitzkrieg.

C.

We return now to our earlier contrapuntal themes of (a) the independent efflorescence of science during that score years of power-eclipse that affected the Democracies and victors of the First World War and (b) science's and scientists' progressive involvement in international politics by reason of the Nazi attacks on the Free World as a system of power and a system of the cultivation of independent science and scholarship. While the initial manifestation of the second theme was in the form of assistance through the academic placing of exiled scientists and scholars from 1933 on, the dual sequences of the interlinked Nazi ideological campaign against freedom of research and thought and piecemeal aggressions projected from 1936 on, first in Britain and later on in the United States, the problem as defined in an article in Nature, near mid-1936, on "Science and Citizenship."

That article pleaded for reorientation by scientists to their civic responsibilities in face of the encroaching and accentuating threats from Nazism. The following extracts defined the problem and culminated with a resounding call for responsive civic responsibility:

"During the past generation, scientific men have generally adopted an attitude of indifference to politics, and active interest or participation in political controversy have been discouraged by leaders of British science ... to justify a policy of aloofness ... For various reasons - the betrayal of scientific freedom in present-day Germany, the frustration of medical progress by large-scale unemployment ... and the shadow of a war which may destroy civilization - there is a new awareness of social responsibility among the rising generation of scientific workers ...

"The popular appeal made by the proposal for a moratorium on inventions is a real danger which now threatens science progress. The undercurrent of press criticism which places the blame for unemployment on a supposedly too rapid growth of technical knowledge is reinforced by fear of the vast disruptive potentialities which science has conferred on warfare. ... Brilliant cultures have been eclipsed in the past and followed by ages of darkness. This may be the fate of our own social culture. If so, social aloofness may prove to have been the betrayal of the scientific movement." (Nature issue May 30, 1936, pp. 883-4; with italics added)

Under the impacts from the progressing military successes of both Fascism and Nazism in 1936 and 1937, and in the immediate aftermath of the formation of the Axis in mid-1937 by the then triadic aggressor-powers of Fascist Italy, Nazi Germany and militarily resurgent Japan, - under the thus mounting dangers, proposals in the American as well as the British press for a stand by the scientists culminated with resolutions passed at the Annual Meeting of the American Association for the Advancement of Science on December 30, 1937 at Indianapolis, Indiana:

"Whereas, science and its applications are not only transforming the physical and mental environment of man, but are adding greatly to the complexities of the social, economic and political relations among them; and

Whereas, science is wholly independent of national boundaries and races and creeds and can flourish only where there is peace and intellectual freedom: now

Therefore, Be it resolved by the council on this thirtieth day of December 1937, that the American Association for the Advancement of Science makes as one of its objectives an examination of the profound effects of science upon society; and that the Association extends to its prototype, the British Association for the Advancement of Science, and to all other scientific organizations with similar aims throughout the world, an invitation to cooperate ..."

At the same time the Association reaffirmed a resolution on intellectual freedom, originally presented by Dr. Robert A. Millikan and Professor Henry Norris Russell as follows:

"The American Association for the Advancement of Science feels grave concern over persistent and threatening incursions upon intellectual freedom which have been made in recent times in many parts of the world. Our existing liberties have been won through ages of struggle and at enormous cost. If these are lost or seriously impaired there can be no hope of continued progress in science, or justice in Government, of international or domestic peace, or even of lasting material well-being. We regard the suppression of independent thought and of its free expression as a major crime against civilization itself ... We feel it our duty to denounce all such actions as intolerable forms of tyranny. There can be no compromise on this issue, for even the commonwealth of learning cannot endure 'half slave and half free'. By our life and training as scientists and by our heritage as Americans we must stand for freedom."

Then in the sequel to Munich and at the beginning of 1939 a Manifesto by American men-of-science - with 1284 signatures, inclusive those of three Nobel

Prize winners in physics - was issued on the relations of science to the international political situation in and from the Totalitarian States. Reaffirming that science:

"Is independent of national boundaries and races and creeds..,"

it concluded as follows:

"If science is to continue to advance and spread more abundantly its benefits to all mankind, then the man of science has a moral obligation to fulfil. He must educate the people against the acceptance of all false and unscientific doctrines which appear before them in the guise of science, regardless of their origin."

Let present-day reading of the foregoing resolutions in reaffirmation of basic principles of freedom may be regarded as 'matter-of-course', their importance and import for the American national situation in the late Thirties and in the immediate wake of the outbreak of World War II lie in having galvanized the scientific communities in the direction opposite to the public's acquiescence in the Neutrality Act and even recoil from the Act's modifications that were being pressed by President Roosevelt in the summer of 1939, so that the U.S. could reinstate trading with the Allies in military defense goods on a pure commercial basis. - In sum and in fine the inspiring and organizing of scientific bodies and their member-scientists in behalf of principles and procedures to preserve and persevere in the defense of freedom for science world-wide, constituted the preparedness of the scientists for their imminently unfolding roles in the Atomic Project. The above cited resolutions in the flux of political turbulence within our body politic were for American science and the educated public generally a sort of secular equivalent to the prayer in the Collect that ushers in the Advent Season: "Stir up, O Lord, the wills of thy faithful people." Through that redirection of thought and will came the enthusiastic response and dedicated labors by the hosts of scientists and technologists and industrialists that brought to fruition the Atomic Project as an instrument of victory and as model for the postwar scientification of the U.S.

BEARINGS FROM THE DECLINES IN MILITARY AND ECONOMIC POWER DURING THE THIRTIES
 BY EUROPEAN VICTORIES IN WORLD WAR I AND ASSOCIATED U.S. ON PRESIDENT ROOSEVELT'S
 CONFRONTATION IN PRELUDE TO AND IN COURSE OF NAZI INITIATED WORLD WAR II

Through the convergent avenues of the prior chapters we now come to the central task of portraying the historically accrued situations and the forward looking motivations that confronted and impelled the pivotal figure in the contemporaneous history, the President of the United States, to concern himself with aiding researchers in the pure science of atomic energy in the wake of an interesting discovery and to become the directive propeller of its culminative application into a war instrument of victory, inclusive of formulating in the finale of the war peacetime career and influence from it on the reshaping of the United States.

CHAPTER V

BEARINGS FROM THE DECLINES IN MILITARY AND ECONOMIC POWER BY
EUROPEAN DEMOCRACIES AND U.S. IN SEQUEL TO FIRST WORLD WAR
ON ACCRUING RECOGNITION BY PRESIDENT ROOSEVELT OF THE CHALLENGE
AND THE OPPORTUNITY IN THE FOSTERING OF ATOMIC RESEARCH AND
APPLICATIONS FOR WAR AND PEACE

CHAPTER V

Synoptic Picture Declensions over Interwar by Victors First World War in Military and Economic Power, and in Internal Adjustability and Resoluteness: Accrued Recognition by President Roosevelt of the Challenge and Opportunity Involved in the New-Science Fostering for U.S.'s Overcoming Military Threats and for Post-War Economic Expansion

The already dealt-with larger aspects of the Crisis in the World Order need to be coordinated with other aspects to constitute the Conspectus and the Application condensed in the above title. That thematic title throws into sharp relief the multi-faceted fact known to, but thus far left unrecorded by, the decreasing few who had been close to the President, and had collaborated with him on the Atomic Project from idea to realization. Viewing it from another angle, they knew and know that the Project's acceptability on a scientific basis, in the immediate wake of Atomic Fission, came up against negative reactions by the respective Science Establishments in both Britain and the United States - as reflected by an authority on the other side in the initial statement that 'the odds against the possibility of successful military application could be put at 100,000 to 1'.⁽¹⁾ Yet that authority soon became champion, way ahead of opposite numbers on this side, whose operative scepticism perdured into 1941. And beyond such sceptical reactions, the very fact that the crash program for the effectuation of the nuclear chain reaction - by Dr. Enrico Fermi and the University of Chicago group, under the broad direction of Dr. Arthur Compton with a long sustained constructive attitude - dates from the near close of 1941, bears witness to the many recurrent and persisting obstacles that were encountered in the aftermath to the arrangement^{that} / this original proponent secured from the President in October 1939 for the establishment of an Advisory Committee on Uranium, outside the purview of the Armed Forces that had already registered their negation. It has thus become incumbent on the uniquely placed proponent to set down definitively that the crux of the historifying of the Atomic Project consists in this triune situation:

(1) Quoted in M. Gowing "Britain and Atomic Energy 1939-45, page 35, 1964.

- (1) The President's deep mindfulness of the accrued near-breakdown in the world situation on the eve of the military threats in 1939 to Europe deemed bound to spread to the U.S;
- (2) his conversion to the tremendous potentials in the event of demonstrable feasibility of the Atomic Project; and
- (3) the persistent labors, in the wake of the October 1939 decision, with him and through him, -- with the mighty aid -- still inadequately recognized -- from the earlier conviction-crystallization and probability-demonstration of feasibility by the British group -- for surmounting obstacles and will-weakness, with consequential maintenance and reinvigoration of what became, after 1941, the Operation Atomic Project.

A.

Accordingly, we proceed to present the equivalent of a brief and sharp etching, instead of a large detailed mural, of the accrued near-breakdown of the World Order, as it confronted President Roosevelt, -- who in autumn 1937 had voiced Cassandra forebodings in the Quarantine Speech, so unheeded by the then Congress and the press -- and as it motivated him to attach new importance to basic and applied science for the revitalization of the U.S. polity and economy Dur-War and Post-War. That etching we present as an octet for the conditions and causes confronting the world at war outbreak in 1939.

1. What after military victory at the end of 1918 were evolved as territorial Peace Settlements in the remapping of Europe and of other Continents left not only conflicts of interest but from precipitous disarmament left a shortage of Military Power and Prestige, accentuated by the U.S. legislative non-approval of the Treaty and the League and consequential detachment from the tasks of adjudicating carry-over issues and Peace Enforcement. Moreover, the Reparations System as obligations by the Defeated to the Victorious Powers met from the start with intractable resistance from Germany, and with the latter's outflanking of the French military sanctions. That crisis was treated by the device of loans from the U.S. and British investors for the rehabilitation of Germany, out of which reduced reparations chiefly to France were to serve for reconstruction.

The companion interallied debts or outstanding obligations from our associated Powers in the war to the United States were accorded reduction-settlements from the mid- to the late-Twenties of our postwar internal prosperity. But the failure of timely coordination of these settlements with the Reparations System left the European Continent in much dampened recovery.

2. As the Versailles Peace had remapped Europe in newer, smaller and disjointed sovereignties compared with the Continental larger free-trading areas prior to the War, the world's trading patterns became shrunken and impaired by tariff barriers, in turn aggravated by struggles for independence in the colonial areas outside of Europe controlled by the European Powers.

3. As the belated shift by the U.S. from neutrality to war participation in 1917 was mediated by idealistic aims of President Wilson that could not and failed to be embodied in the Peace Settlements, there emerged from the end of the combat disillusionments by the intelligentsia in the United States and also in Europe with not only the prior war but with the political system and governance of and by Democratic Countries.

4. Coordinately, as sequel to the collapsing power of Czarist Russia as a war Ally, the Bolshevik Party took control in October 1917, and made separate peace. While checked in its aims of Communist Revolutions in the rest of Europe, it became the ideological challenger to and subverter of the whole political and economic order of the Western System. The original anti-Czarist sympathies of the intelligentsia in the Western World were transferred to the new Soviet Regime, which transfer was mediated by the disillusionment with the results of the 1914-1918 War.

5. Then ensued Counter-Democracies of the Right, as early in the Twenties by the Fascist take-over of Italy, and as a party of agitation for power-capture in Germany under Hitler through Nazism as ideology. These Counter-Democracies of the Left, led by Communism, and of the Right, led by Nazism, served as forces of political-social disruption of the former cohesions in and between the parliamentary and democratic countries of the West. These trends were re-enforced by the emotional-intellectual attachments on the part of the Western intelligentsia to the Soviet propagandized substitutes for the Democratic orders and representative self-government in the free Western countries.

6. Though the Twenties were characterized by prosperity and even boom in the United States, with only moderate recovery in Europe, the sought and expected return to the "normalcy" of the pre-World War I System was frustrated and later reversed by the Great Depression of 1929 to 1933 from the above indicated defectiveness of the Peace Settlements and impairment of what prior to 1914 was a relatively stable and adjustable system of international economics and monetary investment system knitting together Europe, the United States and the other Continents inclusive of colonial and other dependencies.*

7. The above-described and causally traced entry by Europe and the U.S. on the Western Democratic System on a Great Depression with derivative international financial upsets brought in its train chronic unemployment on a hitherto unexampled scale. Thus the Western Order of Political Economics became the target of ideological attacks by the anti-democratic forces of Communism and Fascism and their sympathisers.

Within each Western nation there developed splits, or social-political fission - to use the since available illuminating term - into (a) on the one hand anti-democratic radicalism oriented towards the Soviet System of claimed full employment and growth under supposititious planning by

*Note Point 6.

While the conventionally accepted explanations for the U.S. Market Crash and the World-Wide Great Depression are keyed into mere national economic considerations and statistical measures of madadjustments, their oversimplified grooves are subject to the criticism by A.N. Whitehead of the penchant by many professionals to think and move in grooves: "There is no groove which is adequate for the comprehension of human life ... and for the concrete contemplation of the complete fact." (Science and the Modern World, page 245)

the Party oligarchy, with suppression freedom of thought, participation in government and other fundamental rights of individuals and (b) on the other hand anti-democratic reactionism by fractions of elites in Western nations oriented to yielding to Nazi-Fascist demands of aggrandizements in territory, out of dread of technological war and on the assumption that the aggressors could be satisfied with limited concessions. Yet both pro-Left and pro-Right groups shrank from timely and science-oriented defense preparation and meeting military challenges ahead of completion re-armament by the aggressor powers.

The Nemesis from such self-imposed defeatism was described two and a half millenia ago by Demosthenes in his First Philippic: "You have never made an adequate plan of campaign for yourselves; you do not foresee any event - until you learn that something has already happened or is actually happening. ... Now things have reached a major crisis, and it is no longer possible to get away with this (policy)... It seems, Athenians, as if one of the Gods, from shame at this policy of our city, has put this aggressive appetite into Philip ... Now by always attempting something new and grasping after more, he may perhaps provoke even you, if in fact you have not already abdicated all moral purpose." **

*Note Point 6 (continued)

The alternative multi-dimensional explanations (condensed herein) aided discernment by end-1928 of the on-coming Market Crash and Great Depression. Moreover, the correlative discernment of the interconnection between these developments and the by then accrued near-breakdown of the Settlements after the 1914-18 Great War foreshadowed the on-coming British Crisis, and led to an advisory role to the Lords Reading and Lothian and to Sir Josiah Stamp during the unfolding British Crisis of 1931.

That record led to a call in late-1932 to a confidential advisory role to the newly elected President Roosevelt. In a Memorandum of the period the deeper roots and ramifications of the financial and economic difficulties were thus briefly designated: "The outstanding feature of this Great Depression is that the Economic Order and the Great Society developed since the Renaissance have come to be threatened by a disintegration from within, because of failure of social will and political wisdom" (From "Reprints on Recovery" in Monograph No. 2 for Cowles Commission Research in Economics, by C.F. Roos, page 520).

**Note Point 7

At this long interval from the events, some among the survived concerned challengers of the terrible drifts are at last providing fuller and deeper perspectives. Thus the professional French strategist General Andre Beaufre in his recent book, "1940: The Fall of France," reinterprets the Maginot Line as symptom and manifestation of political

8: Moving back from the late to the earlier Thirties and treating the years integrally, after the onset of the Great Depression, there was inaugurated the series of military encroachments upon and violations of the territorial Settlements of the Versailles Peace Conference. It started with Japan's aggression in 1931 against China through the establishment of Manchukuo. The then effort of President Hoover and Secretary of State Stimson to counter that aggression through submissions of the issue to the League of Nations was outflanked by Japan, through just resigning from the League, with the United States refraining even from the later adopted device of "economic sanctions" in the Italo-Abyssinian case. Then, on the accession to power by Hitler over Germany there were inaugurated the violations of Human Rights through internal oppressions and expulsions, also affecting science and scientists as sketched in the previous Chapter.

The Nazi inauguration of rearmament in 1934 in violation of the Peace Treaty was followed by the reoccupation of the Rhineland in 1936; Fascist Italy's successful war against Abyssinia in 1936-37, accession to that Alliance by Japan in 1937, forming a joint Axis. Then came the annexation by Nazi Germany of Austria in March 1938, subjection to control of Czechoslovakia in September 1938, and to total control in March 1939. Thereafter came the claims upon and the invasion of Poland in September 1939, as the Second World War against Britain and France. The military domination in 1940 over Continental Europe was followed by Axis operations signaled by the engulfment of the United States at the end of 1941.

****Note Point 7 (continued)**

and moral decay and of indifference to the bearings of science on defense against the science-exploiting enemy. Even the decision to build that Line took ten years to put into execution: the debility from which France had been suffering through pacifism by the Left against defense expenditures and appeasement by the Right against challenge-meeting culminated in the hopeless fatalism in GHQ in the final weeks. Therefore, he concludes: "Contrary to various biased theses ... it is apparent that everyone was in some degree party to what happened."

In contrast, in both Britain and the United States the awakening occurred from late-1937 on: through "saving-remnants" in the bodies politic and social, saliently inclusive of scientists, as well as through forethoughtful and resourceful political leaders in the English-speaking world.

B.

The traced interconnections between the Western System's political and economic maladjustments that accrued over the inter-war period had special features in the United States that need delineation for the influence they exerted on President Roosevelt in later domestic and international policies and particularly his attunability to and then attachment to the Atomic Project during the vicissitudes in 1940-1941.

Recalling the President's career as Assistant Secretary of the Navy in the Great War and the narrow margin in the Senate by which the U.S. as later head of the War Coalition was detached from the Treaty and Peace maintenance, the crisis of the U.S. internal economy and polity in his accession to the Presidency was viewed by him in international perspective, notwithstanding the necessitated concentration on domestic issues and early recoil from the then addiction to mere international formulas. Parenthetically, the advisor's independent recommendation of use of Public Works Funds for reconditioning the Navy and for improvements in national defense struck a responsive chord. And as recorded in the previously referred-to Testimony, cognisance was taken from the outset "that the advent of Hitler to power boded ill for all the democracies and necessitated our taking time by the forelock" (Senate Transcript of Revised Text, page 554).

But from the mid-Thirties on, the inaugurated^{oppressions} and territorial demands by the Nazi tyranny evoked from legislative leaders in the Congress attitudes of restraint crystallized in the Neutrality legislation that had such potent popular backing that in the then opinion of the President would have passed over his veto. Across the humanitarian responses to the persecuted by the vast public, the politicians - under the carryover influence from the intelligentsia's attacks on business' role in the War - accepted the mishistory of the Nye Hearings and in 1937 passed the more drastically revised Neutrality Act. In that form the U.S. was closed to access by

victims as well as authors of aggression for arms purchases and even certain related trade transactions. It would of course have operated to the benefit of the Aggressor Powers, already enriched by their annexations and the network of exploitation commodity-arrangements with Southern Europe and Latin America. Concurrently with the piecemeal aggressions and annexations by the Nazi Regime there evolved a public recoil from the threats to our own safety on the assumption that isolationism and concentration on this Hemisphere could provide security.

Now the enlarging international aggressions from mid-1937 on coincided with the topping-out and reversal of our economic recovery and expansion of the two prior years. Thus, as confidential economic advisor to President Roosevelt and proposer of revisions in economic policy, in a visit to Hyde Park, a document was submitted on January 12, 1938 containing confirmations by European and Australian authorities for urgent reorientation from consumption and income redistribution to stimulation and incentive for constructive plant and equipment investments. All this was conveyed to the President in the setting of Cassandra warnings on Nazi military preparation inclusive of technological advances. (Letter included as Appendix)

later

In the course of conferences allusions were made to the rapid and varied science progress, in the light of prior attendance at the Cambridge Lectures. In that connection, it was recalled that F. W. Aston of Cambridge in his lecture on Atomic research in/ ^{cluded} in the book entitled "Background to Modern Science" (published after Munich 1938) declared in conclusion as follows:

"Personally, I think there is no doubt that subatomic energy is available all around us, and that one day man will release and control its almost infinite power. We cannot prevent him from doing so and can only hope that he will not use it exclusively in blowing up his next door neighbor." (This was quoted in the writer's opening Testimony at the Senate Hearings 1945, Revised Transcript, page 558)

- 3 -

Then as the proffered and accepted economic and financial remedies began from late 1938 on to become manifest in economic recovery, counter programs were being pressed by the academic advocates of the theory of Economic Stagnation and imputed complete Maturity for the United States, as a sort of economic analogue to autarchic politics and isolationism for the United States. The chief exponent of it was Professor Alvin Hansen of Harvard University who had wide following among the younger economists. In his Presidential Address before the American Economic Association in December 1938 he declared as follows:

"It is my growing conviction that the combined effect of the decline in population growth, together with the failure of any really important innovations of a magnitude sufficient to absorb large capital outlays weights very heavily as an explanation for the failure of the recent recovery to reach full employment."

Representing the same school of thought, another economist at the same meeting of the Economic Association suggested the failure of business to provide the new industries to absorb generated capital and to supply full employment. He proposed that that function be assumed by "the local and federal government" and that it be combined with altered "distribution of national income."

"Should new industries fail to materialize in sufficient volume to demand large private capital outlays, a continued expansion of the demand for capital goods appears to be contingent on the assumption of large responsibilities by local, state and federal governments to provide for the expansion of investment. Such expansion can take the form of large expenditures for public works projects and the development of capital facilities which tend to stimulate business enterprise. These direct forms of expanding that demand for capital goods might well be combined with some means of changing the distribution of the national income, so that large bodies of consumers may have enough purchasing power to require the physical expansion of existing industries."

Now what to this critic of that school - in both his advisory role and in public submissions - seemed so extraordinary was that the advocates of "U.S. Stagnationism" wore blinkers on (a) the elicitable "new industries" from the

burgeoning new science and (b) the aborting of the 1936-7 expansion by reverting to the constriction of incentives to long-term entrepreneurial investments. As rounding-out to follow-ups to the letter of January 12, 1938 to the President, the writer presented publicly his challenge to that school before the New School of Social Research on March 24, 1939. The concluding advice was as follows:

"As one who from the very start has been urging clarified and delimited aids and instrumentalities by the government for economic revival and balance, instead of confused monistic planning and interventionism, it seems to me that the very shortcomings and failures of our experiments of recent years, and the correlative failure of the Popular Front's experiments, should lead political and economic liberals to shift the focus of their interest from "exposing" the abuses and inadequacies of laissez-faire-ism to revising and rationalizing the reforms and controls we have attempted and found wanting."

As for the dangers in and for normal economic functioning from controllism to the emergence of "new industries," there is the luminous example (that was described to the President in a conference) at the inception of the British Industrial Revolution: how the young James Watt trying to devise an economic steam engine came up against the anti-experimentalism of the Glasgow Guilds and the powers of restraint by that incorporated city. At that juncture the Adam Smith, whom history recognizes as the founder of modern economics - with his "Wealth of the Nation" published in the year of the "Declaration of Independence" - stepped in to remedy the enterprise-frustration from irrational controls. He arranged a post for James Watt in the independent Glasgow University, and thus removed the shackles to the origination of new industrial technology from irrational labor and government from the then "Hammerman Guild" and the Incorporated City of Glasgow.

In the thus marginally lit up economic-policy struggle in the period 1938-9, the labors for the continued improvement in economic fiscal policies and governmental management for reinvigorating the U.S. economy became interfused with correlative labors on the international political and defense requirements for meeting mounting challenges from aggressions.

Then just ahead of the consolidation by Nazi Germany of its mastery over Czechoslovakia in mid-March 1939, the presentation in the usually read and spoken

form of the memorandum of March 10, 1939 on the international crisis was linked-up to the highlights from the Bohr conferences. That presentation was concluded with urging defense programatics as follows:

"What can and must be done for our safety and salvation is self-reorientation and defense-reorganization toward the onrushing dangers. There is still time for the exceptionally and favorably situated United States, to use time drafts on the 'Bank of History' - with the maximal utilization of fostered science - for the preparedness that has become urgent and inevitable for Western Civilization, as a result of the past errors committed and in prospective unfolding of aggressions by Nazi Germany." (This excerpt was in large part used in this writer's testimony before the Senate Committee on Atomic Energy which had opened their hearings on November 27, 1945 - "Background and Early History Atomic Bomb Project in Relation to President Roosevelt" - pps. 553-573, at p. 555)

CHAPTER VI

REVERBERATIONS AND REACTIONS IN U.S. FROM ATOMIC FISSION EXPERIMENT EFFECTED IN GERMANY AT END-1938, THROUGH NIELS BOHR'S VISITS WITH AMERICAN PHYSICISTS FROM MID-JANUARY TO APRIL 1939

A.

The above designated "reverberations" from the epochal experiment of atomic fission, as effected in Germany near the end of 1938, was set going ahead of publication among the elite of the American physicists by Professor Niels Bohr of Denmark, who since the death of Lord Rutherford was regarded as the dean of the atomic physics profession. The tidings brought by him were in a setting of the type described in the preceding Chapter as eventuation-intersections between (a) the professional-social relations of Professor Niels Bohr of Denmark and Professor Enrico Fermi, then of Italy, on the occasion of the September 1938 Annual Seminar of Alumni of the Bohr Institute for Theoretical Physics and (b) already portentous undertones from Nazi policies of racialist persecution, as affecting scientists and the practice of science, that then hastened the exodus of Professor Fermi and his family to the US. The visit by Professor Bohr to the US was in an accentuated case of this pattern of eventuation-intersections, to wit between (a) the arranged professional exchanges between that dean and the US community of atomic physicists, as opening up from the academic base at the Institute for Advanced Study at Princeton, and (b) his already noted involvement in behalf of free science and scientists under the then intensified persecutions by Nazi Germany and the accelerating aggressions and world war threats by Nazi Germany. On the one hand, there was an epochal experiment by Professors Otto Hahn and Fritz Strassmann that was completed at the Kaiser Wilhelm Institute for Chemistry in Berlin-Dahlem, - which, as shown later, was at the time being reinterpreted by collaborators of Bohr - and, on the other hand, there were the

heightened concerns over war threat and potential peril for the whole Free World should the explosive energy disclosed by that experiment be convertible into instruments of destruction.

The intense interest aroused by Professor Bohr among the physicists at the Institute and at Princeton University enveloped also scholars in other disciplines that at the time were deeply concerned about the threats of Nazi aggression on the whole world order, among them close associates and friends of this very predestined protagonist of the Atomic Project. They included the retiring Director of the Institute, Abraham Flexner, and the successor Designate-Director, Frank Aydelotte, ex-President of Swarthmore, - with both of whom the writer had conferred on the Institute in its formative stage and the then world situation in the summer of 1934 as a group of guests at Lord Lothian's estate in Aylsham, England - and two economic colleagues and friends, then members of the Institute, Robert B. Warren and Walter W. Stewart, the latter also Trustee of the Rockefeller Foundation. It was from these sources that late in January the tenor of Professor Niels Bohr's tidings was conveyed to this writer, and it was at their behest that a visit was undertaken to the Institute at the opening of February 1939 for the discussion of new developments and for independent reinforcements by him of Professor Bohr's anxieties that Nazi Germany was moving to total war, starting with this writer's expectation of "a coup in Czechoslovakia around the Ides of March."⁽¹⁾

1
(1) Exhibit as Appendix to this Chapter of original Notes, as written and as later transcribed, entitled Origins of Concern With Significance of Atomic Research for US Defense and for US Role in the Overwhelming World Crisis From Beginning-1939, Covering Conferences at the Institute, February 3-4, 1939, March 17-18, 1939 and April 21-22, 1939. Photostatic copies of whose notes were utilized by the official historians to the US Atomic Energy Commission of the Atomic Project, in the book The New World, 1939-1946 by R. G. Hewlett and O. E. Anderson, Jr., Pennsylvania University Press, 1962, Chapter II, in the beginning pages 9-52, and Note 13, at page 669.

In connection with then continuing submissions on the world situation to the President, news of the Princeton Conferences was conveyed, in their international bearings, as articulated in the writer's notes (as described in note (1) on the previous page). Ahead of the Nazi takeover in Czechoslovakia was also issued and conveyed the separate memorandum of March 10, 1939, entitled "On Imminence World War in Perspective Accrued Errors and Crisis of the Interwar Decades" (as was referred to in the testimony immediately after the war that, at the behest of the Chairman of the Senate Atomic Energy Committee, was presented by the writer on November 27, 1945). In keeping with the contemporaneous notes after the visits to Princeton, the writer, who had been a consistent reader since the end of the Twenties of the international scientific journal Nature of London, awaited receipt of the issue containing the interpretations by Professor Meitner and Dr. Frisch of the Hahn-Strassmann experiment; and also arranged later for the translation of the German article in Die Natur Wissenschaften issue No. 1, 1939.

Now with regard to the thesis in the preceding Chapter, that the correct interpretation of the results of the fission experiments stemmed from Drs. Meitner and Frisch, the residue from the personal dramatizations to which press and radio are addicted has left the impression that the experimenters had consciously reached the conclusion that they had accomplished atomic fission. But the preceding Chapter's interpretation was originally conveyed to and reported by the writer in the above referred-to contemporaneous notes, based as they were on Professor Bohr's then report of his conversation on the eve of his departure with Dr. Frisch. Since this is an essayed definitive recapture of the Project's origination as emergent neo-history, it is advisable to set the record straight, and definitively so. (2)

(2) Curiously, when later that year, in July, the writer met for the first time with that pivotal figure of the period, the genius Dr. Leo Szilard, that postwar popularized version was affirmed by him. About three quarters of a year after the

While only a contemporary instance of the "virtuosi" type of membership of the original Royal Society, this professional in economic and applied science has, through his professional career, striven to evaluate - with critical precision and with check from professional scientists - the nature of the new developments in science. In the instant case the translated text of the articles by Professors Hahn and Strassmann concludes in language of conspicuous clarity their perplexity and uncertainty, as chemists, over the results of their experiment:

"As chemists, we ought to re-name the previous scheme according to the briefly stated experiments and replace Ra, Ac, Th by the symbols Ba, La, Ce. As 'Nuclear Chemists' being to a certain degree connected with Physics, we could not make up our minds to make such a sudden jump contradictory to all known results of nuclear physics. There is still a possibility that a series of queer coincidences might have deceived us in our results. It is intended to make new indicative experiments with the new transformation products ..."
(translation by Professor E. J. Gumbel)

Note (2) Continued .

writer's testimony, that question was again brought up in the light of an immediately preceding discussion with the two French atomic physicists, Drs. Halban and Kowarski. The position taken by the French Delegation countered the then "prevailing theory" and what is designated above in the text as a still present "residual theory." The theory common to them and from the very origin to the writer, via Professor Bohr when at Princeton, assigns, according to my letter to Dr. Szilard, "credit for the fission theory to Frisch and concurrently to Joliet-Curie and colleagues, who independently discovered it at around the same time."

As one of the manifold purposes of this attempted definitive historization is to restore the too blurred roles of Britain and also of France, - the latter having suffered a near total scientific eclipse after the Fall of France - it is advisable to allude to the correspondence-interchange and to supplement it from independent professional sources. Considering the great merit accumulated by that genius of an experimenter and by that zealous promoter of the experimental work, Dr. Leo Szilard, the disclosure of his having had an "Hesperic nod" on the history of the Project can be no reflection upon him, particularly as throughout to the end of his life friendship was maintained across equally maintained divergences on political aspects of the Atomic Project's later career and of interacting international relations.

It was that perplexity that impelled Otto Hahn to communicate his findings ahead of publication to Lisa Meitner, who up to Hitler's takeover of Austria in the spring of 1938 had been the coequal third member with Hahn and Strassmann, and had previously published articles on Atomic Physics, including one which had put her name at the head of the trio. That inquiry occupied her and her nephew, Otto Frisch, on their Christmas holiday near Goeteborg. Both the humane and scientific aspects of it are now available in the chapter by Otto Frisch contributed to the book that was edited by S. Rosental, a colleague of Niels Bohr, under the title Niels Bohr, His Life and Work as Seen by His Friends and Colleagues, issued by the North Holland Publishing Company of Amsterdam in late-1967. From that book and other sources the ensuing indented resume is submitted:

As reported in the book, Meitner and Frisch at their Christmas holiday dismissed the inference that had been made and reported by the German scientific duo left from the original trio that barium could be formed from uranium. Using Bohr's liquid-drop model they held that the neutrons set up the violent internal motions that caused the split and fragmented the uranium atom into two nearly equal halves. They concluded that the presence of the barium meant that a new type of nuclear reaction had taken place, to which Frisch, using an analogy from the biological cell, adopted the term "fission". They calculated that the tremendous amounts in volts of energy released and checked it against the Einstein equation for the estimated loss of mass. They went further and outlined an experiment for verifying their hypothesis. After their holiday, Meitner returned to Stockholm and Frisch to Copenhagen, where he just caught Bohr on the point of departure to the United States. Upon receiving from Frisch the rough notes of the calculations by Meitner and himself, Bohr urged immediate publication. Thus, right after Bohr's departure they exchanged views on the telephone to Stockholm and later performed the experiment.

Their initial hypothesis of fission is what was transmitted by them and published in Nature on February 11, 1939, and their consequent experimental results were published in the issue of March 18, 1938. Bohr's own rethinking of the first formulation led to a letter that he sent on January 20th to Nature (published in the issue of February 25, 1939) on "Disintegration of Heavy Nuclei," in concurrence with the Original Hypothesis.

The alluded-to experimental test for the Fission Theory, as jointly carried out by Meitner and Frisch, was sent to Nature on March 6th and published, as already noted, in the Issue of Nature for March 18th. The concluding sentences (apart from credit for aid given to them by the Stockholm and Copenhagen Institutes) dispose of and dispel the theory of 'transuranium' mesetai production as the original experiment's results:

"From these results, it can be concluded that the transuranium mesetai originate by fission of the uranium nucleus. More capture of a neutron would give so little kinetic energy to the nucleus that only a vanishing fraction of these nuclei could reach the water surface."

The very same issue of Nature, March 18, 1938, - with the same transmittal date of March 6th - contains the communication from the French trio - H. von Halban, F. Joliet and L. Kowarski - on "Liberation of Neutrons in the Nuclear Explosion of Uranium." The opening reference to "recent experiments" mentions previous publications by members of the trio, yet it includes no direct reference to Hahn and Strassmann. The concluding paragraph of that communication appears to be the first published reference to "chain reaction."

"The interest of the phenomenon observed as a step towards the production of exo-energetic transmutation chains is evident. However, in order to establish such a chain, more than one neutron must be produced for each neutron absorbed. This seems to be the case, since the cross-section for the liberation of a neutron seems to be greater than the cross-section for the production of an explosion. Experiments with solutions of varying concentration will give information on this question."

As check on the foregoing review and particularly the initial position by a nonprofessional reader of Nature regarding the transformative re-interpretation by Meitner-Frisch of the Hahn-Strassmann experiment, there is submitted the later confirmation in Nature by Dr. N. Feather of the Cavendish Laboratory at Cambridge. From the start, Dr. Feather became a member along with E. Bretcher of the British "Maud Committee," which spearheaded the important British research, and which throughout the years 1940-41 served as recurrent stimulator

and reinvigorator of the US groups during the prolonged origination across the fluctuation of attitudes. His résumé of the Fission Research was in an article in the issue of May 27, 1939 entitled: "Fission of Heavy Nuclei: a New Type of Nuclear Disintegration."

That article treats first the Hahn-Strassmann experiment as a continuation of the work of Curie and Savitch in May and October 1937 and September 1938 as follows:

"The work of Curie and Savitch immediately prompted a further search for activities belonging to elements of atomic number less than 92 produced in the uranium transformation, and, as a result, Hahn and Strassmann discovered two other lanthanum-like and three barium-like products. These workers believed that they had demonstrated the production of each of the former species from out of the latter, but at that time they still inclined to the view that actinium and radium isotopes were really in question. However, in January of this year, they reported that fractionation of the new bodies ... invariably concentrated the neutron produced activity with the lighter carrier and resulted in a complete separation ... The conclusion now appeared inescapable that active isotopes of barium and lanthanum were among the products of the bombardment of uranium with neutrons.

"At this stage, Meitner and Frisch discussed the problem on the Bohr theory of heavy nuclei, making particular use of the essentially classical 'water-drop model' of the highly condensed system of particles of which such a nucleus is constituted. They concluded, "It seems therefore possible that the uranium nucleus has only small stability of form, and may, after neutron capture, divide itself into two nuclei of roughly equal size These two nuclei ... should gain a total kinetic energy of c. 200 M.e.v. ... This amount of energy may actually be expected to be available from the difference in packing fraction between uranium and the elements in the middle of the periodic system.

~~Frish~~ Frisch obtained direct evidence for the projection of fission fragments with approximately the energy predicted, being able to detect the production of large bursts of ionization in a uranium-lined ionization chamber which was irradiated by neutrons. Similar results were obtained when thorium was substituted for uranium in the chamber, and it was concluded that some of the activities previously ascribed to isotopes of radium and actinium,

in this case also resulted from fission of the nucleus under neutron bombardment." (Italics added, also additional abbreviations. Reference 7 and 8 apply to the Nature articles of February 11 and March 18 by Meitner and Frisch, previously discussed.)

B

Returning to the mission of Professor Bohr with and repercussions upon the American scientific community, it was towards the end of the month, precisely on Thursday, January 26th, that the Fifth Washington Conference on Theoretical Physics was held at George Washington University under the sponsorship of that University and the Carnegie Institution of Washington, then headed by Dr. Vannevar Bush. At that Conference Bohr met Professor Fermi and found the latter skeptical of the explanations that he had heard from Professor I. I. Rabi, who had attended the Princeton meetings. As a reporter from "The Science Service" and the director of that "Service" were already in possession of the Hahn article from the German scientific publication, just arrived, the whole subject entered in the public domain and Bohr spoke the more freely, with special emphasis on the interpretation that was given by Drs. Meitner and Frisch, whose publication in Nature was imminently expected by him.

Then ensued, in the very closing days of January, repetitions of the Hahn-Strassmann experiment in its new character as Atomic Fission at the Carnegie Institution in Washington and also at Baltimore and Berkeley. Reports of that elevated the historic tone of the closing days of the conference at Washington.

But, running counter to Professor Bohr's prior eagerness to avoid publicity, the newsmedia issued releases, specifically "The Science Service", the "Washington Star." Then the "New York Times" declared resoundingly in headlines the following: "The splitting of the uranium atom into two parts, each consisting of a gigantic 'cannon' ball of tremendous energy of 100,000,000 electronic volts, the greatest amount of atomic energy so far liberated on earth, was announced here

yesterday by the Columbia University Department of Physics." But no reference was made to the verifying experiment, due to the delay of publication in Nature. Then on February 1st Bohr did receive a cable from Frisch at Copenhagen and Bohr sent a copy of the cable to Fermi, together with an announcement of a prospective article by him in Science. Another confirmation came to Bohr in the early part of February from a newly arrived member of his Institute, Dr. Placzek. The report on the Meitner-Frisch confirmatory experiments constituted reassurance that all the "trans-uranic elements were fission products."

As that designation "trans-uranic elements" had been circulating in the physics literature since the Fermi experiments in 1934, that new conclusion of their nature in the experiment as "fission products" closed one subject and thrust into the forefront the subject of the difference between Uranium 238 and that rare isotope of Uranium, U 235, which is such a tiny fraction of U 238. Bohr then advanced the theory that it is the U 235 isotope within U 238 that effects the fission with the intake of slow neutrons, rather than the U 238, which merely captures the neutrons. That presentation to colleagues from Copenhagen and to his American original student, now a colleague, J. A. Wheeler, projected at that early stage the idea of the necessity of separating the extraordinary scarce U 235 from the abundant U 238 for its susceptibility to Fission under action by slow neutrons.

Within a few days, namely, on February 7, Bohr sent to the Physical Review his article entitled "Resonance in Uranium and Thorium Integration and the Phenomenon of Nuclear Fission." His very opening reference was to Fermi as the initiator (back in 1934): "The story of the nuclear transmutation by neutron bombardment in uranium and thorium initiated by Fermi and colleagues, and followed up by Meitner, Hahn and Strassmann, and by Curie and Savitch, has brought forth a number of most interesting phenomena." He also promised a forthcoming paper with Professor Wheeler on "The Fission Mechanism and of the Stability of Heavy Nuclei in their Normal and Excited States." Notwithstanding voiced skepticism in important quarters towards that theory

regarding U 235's pivotal role, the theory received vindication before the year end from the very labors of Bohr and Wheeler.

Seeking to involve Fermi in further experimental tests, Professor Bohr in a visit to New York first encountered Fermi's associate, Herbert L. Anderson, to whom, in Fermi's absence, he presented his theories. Out of that encounter there soon emerged an experiment with the Columbia Cyclotron that Dean Pegrum of Columbia, placed under the direction of Dr. Fermi as new faculty member and Dr. J. R. Dunning. The project included Herbert L. Anderson, Walter H. Zinn, a Canadian working on the subject matter at Columbia, and a new figure destined to loom large, namely Dr. Leo Szilard. The latter after Berlin had been a refugee scientist at Oxford and in the aftermath to Munich came to the U.S., and functioned as a non-faculty experimenter at Columbia. Their first experimental results sent on March 16, 1939, were published in the Physical Review of April 15, 1939. The net of the experiment was to hint at or cast a favorable light upon the possibility of a chain reaction in as yet untested dual conditions, (a) if uranium were used rather than a lighter element, and (b) if the neutrons could be slowed by some material of low atomic weight.

C.

In keeping with our previously set forth History-Counterpoint of the period it was on the morrow of the Ides of March - which did fulfill the writer's forecast of Nazi violation of the Munich Pact and military takeover of Czechoslovakia that Dean Pegrum of the Physics Department of Columbia, wrote to Admiral Stanford C Hooper of the Office of Chief of Naval Operations at Washington (the one Armed Service which had then research funds) introducing to him Professor Fermi. With regard to the experiment by the Columbia team he alluded to a possibility and then deflated it as improbable:

"...this might mean the possibility that Uranium might be used as an explosive that would liberate a million times as much energy per pound as any known explosive. My own feeling is that the probabilities are against this.."

Professor Fermi, on the morrow, saw Admiral Hooper and talked to a group composed of (a) a number of Naval officers, (b) two civilian scientists from the Naval Research Laboratory, and (c) several officers from the Army's Bureau of Ordinance.

On the basis of contemporaneous echoes in the White House and other Governmental circles, and of the much later confirmation after the War by Mrs. Laura Fermi, in her 1954 book, Professor Pegram's emphatic skepticism was fully shared and voiced by Professor Enrico Fermi. At the turn from the Forties into the Fifties when a copy of the letter was found by Mrs. Fermi, his answer to her query about the absence of any response to the letter by the Navy, was as follows:

"You forget that in March 1939 there was little likelihood of an Atomic Bomb, little proof that we were not pursuing a chimera." (Laura Fermi, "Atoms in the Family", pp. 162-4, U.C. Press, 1954)

What surprised this source about the communication from Columbia was the absence of any reference to Nazi aggressions and Nazi terrorization with technical weapons, as bearing on the possibility, however remote, of such an enormously potent explosive. But that shortcomings in the communication were not the source of the above non-responsiveness is evidenced by the later negative reaction by the Navy following an exchange between a member of the Columbia team in late-June 1939 with the Technical Advisor of the Naval Research Laboratory in Washington.

It was at the meeting of the American Physical Society at Princeton during the last days of June 1939 that Dr. Szilard approached the Technical Advisor of the Naval Research Laboratory as to "whether the Navy would consider supporting" the then experimental work at Columbia on uranium. The initial response was that "it seems almost impossible." Then on July 10th, 1939 in an official letter from the Naval Research Laboratory at Anacostia Station, Washington, D. C., Mr. Ross

Gunn, the technical advisor, reported that the subject had "been carefully considered": "In the light of the restrictions which are imposed on Government contracts for services" it appeared "almost impossible to carry through any sort of an agreement that would be really hopeful." Though concluding with the wish "to cooperate in every respect", the immediately preceding sentence was, "I regret this situation but see no escape." (A reproduction of this letter is included as Exhibit 1) -- It is noteworthy that this negation of interest in support came after inquiries by Admiral Harold G. Bowen, the Director of the Naval Laboratory, on March 20th or three days after Fermi's conference and talk before a group that included Mr. Ross Gunn, regarding power potentials and the Navy's request of the Carnegie Institution for an experimental test, which was carried out by it from its own budget, and not through the use of Naval funds. Then on June 1st, 1939, Mr. Ross Gunn wrote a report to Admiral Bowen on the internally carried out consideration of the problem.* The thoroughgoing negativism of the letter is recognized by the historians on the project for the Atomic Energy Commission in the book "The New World 1939-1946", pages 15 - 16.

Now while the attitude of the Services came into/ken, it has already been made clear that on any comprehensive appraisal of the U. S. situation in the unfolding military situation mere support for single experiments could not be the answer. The prerequisite was embarking on Defense on a scale and with the dynamics of innovative science. By a time conjuncture in early July, I received word from Lord Lothian regarding his appointment as Ambassador to the U. S. and before the end of July further advice regarding his arduous undertaking: as he had already effected in the prior year his thoroughgoing conversion to resistance, there came in appreciation of my prior submissions, illuminative material from internal British government sources on the already emergent interfusion of science and defense. The

* This makes puzzling Admiral Strauss' attribution to the Navy of "palms for imagination and initiative" having been then "the first department of Government to become seriously interested in "the power potentialities of atomic energy." The only explanation is that while he was aware of the June 1, 1939 letter, he was not aware of the letter of July 10th. (L.L. Strauss, "Men and Decisions," pp. 180, 238)

revolutionary character of that shift seemed to me the right correspondent for our situation rather than what in that phase was preoccupying the atomic experimenters at Columbia as revealed to me in late-July by Dr. Szilard himself.

Importantly the then entry on Ambassadorship in Washington by my British friend, since 1931, became a source of flows of vitally relevant information until his lamented early passing in December 1940. For illuminative bearings on this advisor's primary concern with science-oriented defense, it is advisable to illustrate from the very first impact received from the newly emerged shift in Britain from conventional preparedness to science-oriented preparedness.

It was in the wake of the Defense Program in 1937 that the then Secretary of State for Air established a Scientific Committee under Sir Henry Tizard on how to counter air attacks, - the then paralyzing dread for the populations of the large cities in England and France. The national scientific organ of the National Physical Laboratory through the head of its Radio Department had been asked to investigate a then popular and what we would now say science-fiction solution for air attacks, namely the "death-ray." The technical evaluator of that proposal, Mr. (later Sir) Robert Watson-Watt estimated the tremendous amounts of electromagnetic energy for intercepting raiding airplanes. But instead of contenting himself with dismissing that popular fictional proposal, he formulated an alternative project which was entitled "Detection and Location of Aircraft by Radio Methods."

Without attempting elaboration of what became a vitally responsive weapon for Britain after the war outbreak - indeed referring the interested reader to the officially assembled documentation on this and other inventions in the official history on "Design and Development of Weapons," H.M.S.O., 1964, - the emergent novelty was that the governmental and military establishments permitted the then Mr. Robert Watson-Watt to supplement his negative by a forward projected task for entering on research for a new weapon instead of proposing an already available but inadequate weapon against the advance technological weapons of the Nazis. That heretical idea far from being shelved was followed up and became incarnated into the technology of what we came to know as radar, without which Britain might have gone under in the post-summer blitz of 1940.

In an anticipatory leap to the Atomic Project of the U.S.

as evolved - in magnified transcendence of the type of support implied in Dr. Pegrum's approach to the Navy in mid-March and Dr. Szilard's at end June - generously by the necessarily small scale contribution by the Government to the customary University research in basic science, it is noteworthy that the same Sir Henry Dizard, though originally reacting against the possibility of military application from the atomic research, quickly recommended to Britain the acquisition of uranium and ~~was~~ negotiations with the English Vice-President of the Union Miniere - Lord Stonehaven, who facilitated Sir Henry's meeting with the President Edgar Sengier in London on May 10th - for a substantial stock of uranium.

But after Nazi Germany's annexation of Czechoslovakia the clouds of war were thickening in the midst of lightening preparatory blows such as Italy's annexation of Albania on April 7th; Germany's annulment at the end of April of its non-aggression pact with Poland, and thunderous propaganda against France and Poland; the early April bilateral guarantee between Great Britain and Poland then came up for attempted negotiations with Soviet Russia by conjoint British and French delegations in the dim hope that Russia, which was still a theological target of Nazi Germany, would join the Allies.

Meanwhile the President was valiantly struggling with the Senate and particularly the then leader of isolationism and neutralism, Senator Borah, for revisions of the 1937 Neutrality Act. He and the esteemed southern Secretary of State, Mr. Hull, encountered intransigence from Senator Borah who even proclaimed that his sources of information ran counter to panicky views about war imminence by the White House and the State Department. The President, while feeling that if the public could express itself it would back his position, could not go to the public because the verdict could not be marshalled in time, while both in the interim and after expression the Senatorial neutralists had the votes.

It was in the midst of that that Dr. Szilard, through Mr. Lewis Strauss as banker and public spirited backer of a private isotope project, sponsored jointly for/ Dr. Szilard and Dr. Arnold Brasch, was directed to this friend of the President with the expressed view of securing Government support, notwithstanding the already expressed

counter-attitude of the Services, and particularly the Navy, which as stated earlier did have research funds.

D.

Again in accordance with the contrapuntal rhythms in the evolving history of the period, the closing weeks of the Bohr visit, which ended in April, and the balance of that second quarter, marking the end of the academic year, witnessed accumulating progress in the science end across the retrogression in the international-political situation.

Delimiting first the scientific progress, that second quarter of 1939 telescoped advances in the frontiers beyond atomic fission and led up to crucial questions. Having attained certainty of the relationship between the release of neutrons and the fission of the uranium atom, the main question was as to the possibility of chain reaction in natural uranium. Along with that was the question over which physicists divided as to which isotope fissioned with slow neutrons, - the slow neutrons being regarded as the most likely to produce the fission. Within the Columbia physics community the even more important division was as to whether the rare 235 uranium - considerably less than 1% of the natural element - or the abundant 238 uranium was responsible for the fission. Professor Dunning affirmed 235 while Professor Fermi inclined toward 238 . The former held that if uranium 235 was the isotope subject to slow neutron fission, its concentration promised a chain reaction. The latter was content to try for a chain reaction in the unconcentrated uranium, in view of the extreme difficulty and large expense involved in separating the isotopes. The correlative question was as to the proper agent for slowing down or, as later became the standard word, "moderating" the neutrons. As water, which Fermi had used in earlier experiments, exhibited a tendency to absorb neutrons, in the immediate aftermath of the finished academic year, namely on July 3rd and also July 8, 1939, the advantages of carbon were suggested by Dr. Szilard to Professor Fermi. It was therefore proposed that the Columbia group proceed at once with a large-scale experiment based on graphite as the moderator, - even ahead of tests as to carbon's neutron-absorption characteristics.

But, within the frame of the academic calendar, the third quarter of the year ushers in both vacations and summer sessions. It was the latter that affected

Professor Fermi, who departed for Michigan University for investigations of cosmic rays. Dr. Szilard, as already noted, sought in the post-commencement meeting of the American Physical Society to secure funds from the Navy Department for that large-scale experiment with carbon, even though the Columbia authorities and the pivotal experimental physicist, Professor Fermi, had not yet agreed to the project. As a non-faculty member and experimenter on his own, Dr. Szilard - who later explained the situation to the writer - had been utilizing his own resources from prior applied-science work in Europe that was affected adversely by the war threats. Having since the end of 1937 interested the then banker, Mr. Lewis Strauss, in ^{what} joint project with Dr. Arno Brasch for the construction of what they called a "surge generator" for the production of radioactive isotopes, he received backing from Mr. Strauss in his public-spirited way. So having kept Mr. Strauss advised of the nuclear-research progress during that first half of 1939, the emerged acute problem of resources for further experimenting led him to inquire of Mr. Strauss as to how the opposition by the Services could be surmounted. (The earlier and decisively important episode with Admiral Hooper was not yet in his ken.) The resulting suggestion of an approach to President Roosevelt led directly and indirectly to a convergence on this writer as one in a deemed unique position for presentation of problems involving economics, international relations, and science.

Across the then interlude of academic quiescence, seismic international-political events were occurring in enlarging sweep and in rising intensity. The end-April demands by Hitler on Poland for the incorporation of Danzig and road-rail connections across the Polish Province of Pomorze - an annexation equivalent to the Munich Settlement - were followed by staged agitations about Danzig and also the transport of forces by sea that by July spilled over into Danzig. The late-March and early-April guarantees that Great Britain gave to Poland - though under conditions of foreclosing accessibility - merged into intensifying military preparedness: The formation of a Ministry of Supply was followed up by the passage of conscription over the official opposition of both the Labour and Liberal Parties. Then came unilateral guarantees to Romania and Greece, a special treaty with Turkey, and the opening of negotiations with Soviet Russia, which was still the target of the Nazi propaganda attacks.

Meanwhile, the President was valiantly struggling with the Senate and the House in his dual quests from the former for revisions of the Neutrality Act and from the latter for public works appropriations that could also be used

for defense, (per the authorization in the original and 1933 Public Works measure, already alluded to in an earlier Chapter) A contemporaneous note, preserved by the writer from issues of Time Magazine, summed up the events of late-July and beginning-August as "Senate Stopped the President Cold on Neutrality in Last Fortnight," and with respect to appropriations, "FDR Took Shellacking From the 76th Congress," with the House having "decapitated ... the Public Works Bills."

Traversing these developments were mounting reports on the low morale on the Continent due to queries as to how under the retained Neutrality Act the then gravely unprepared state of France could effect any purchase of military supplies, such as planes. The plight of France was far graver than Britain, which, thanks to the 1937 defense program and the thoroughgoing reorientation since 1938 of the business and intellectual classes to resistance, was already at work on the redirection of the economy to the growing role of defense (as illustrated herein earlier). With the Senate and House oppositions remaining intractable on the vital issues of opening up to the imminently attacked European democracies prospects of Allied aid even on a thoroughgoing economic basis, the President was going through, with a heavy heart, the diplomatic moves in the ritual of appeals to the Nazi and associated powers to step short of a war for total hegemony against the democracies. The culminative humiliation - reminiscent of the earlier quotation herein from the First Philippic was the doublecross of Soviet Russia, which concurrently with negotiations with the Allies conducted parallel negotiations with Germany and arrived at a German-Soviet Pact, with secret clauses regarding partition. At the time ^{FOA} the President and advisors ^{WAS} recalled the applicability to that secret alliance by the two totalitarian regimes, Thomas Hobbes' definition of The Kingdom of Darkness in the following abbreviated terms:

"A confederacy of deceivers that to obtain dominion ... endeavor by dark and erroneous doctrines to extinguish in them the light ... and so to disprepare them."

* * *

In the mounting concerns from the beginning of summer-1939 over imminent war, the advance indication of the introduction given by friends to Dr. Szilard and his desired meeting with me elicited at first a suggestion for deferment until emergence from the mixture of culminative crisis and suspense-

stage that the pre-neutralism Congress imposed on the National Executive. In a conference towards the end of the academic year with the previously designated close connection of the writer to the Institute for Advanced Study, a report on the progress of nuclear research that was made by this interested reader of Nature and of Science elicited an acceptance of requested good offices by Mr. Walter Stewart (Professor at the Institute and Trustee of the Rockefeller Foundation), on resumption of the academic year, in behalf of liberal funds for the acceleration of nuclear research in the universities, - especially Columbia, judging by then already published articles on experimental work. Impressed on the first encounter with Dr. Szilard by his effective presentation, and unimpressed as he in turn was by mention of obstacles to immediate embarking on his program, - because he was in urgent need, for the continuation of his work, of sympathetic signs from authoritative quarters - the problem became how to improvise an overture to what in the literal sense is "opera", a program of works. To be sure, it would be self-defeating even if one somehow projected himself into / ^{the President's} crowded efforts at diplomacy from July on: In that state of mounting pressure, the shared knowledge of the opposition by the Services would rather naturally be invoked by him as a definitive foreclosing of review, while the Congressional leaders in the interest of stymieing his known pro-Ally attitudes have defeated even appropriations programs linkable to defense. Under the deliberate curtaining-off on confidential relations to the President, the attitude in the conference with Dr. Szilard was one of conjoint consideration of the meaning of the reported news about the world and about Washington, It was further stressed that this or any other friend of the President whom Dr. Szilard might approach must not presume even to lend color to the idea of advising overriding the Navy's opposition in the then grave inadequacies of defense to apply

their very meager funds to basic-science financing, which by established practice is within the purview of universities, institutes and foundations. To all of which the response that became a refrain was, 'But some signal of eventual interest is urgent and unpostponable.'" So I evolved and submitted in the later conference the deemed forward-looking program, for the procedure that will be adopted by me in the expected formal presentation to the President at an appropriate later occasion or subsequent to the then pre-combat-war suspense phase. The program, in essence, was the following:

'Let us assemble a dossier or published material together with our joint summary-memorandum on the progress made so far in the atomic research. Let us also get from the scientist we both know, Dr. Albert Einstein, a type of letter for the President which would strike a harmonic chord, since he already knows of Dr. Einstein's noble spirit. The tenor of the letter has to be related to the at once broader and deeper issues of humanity in the alas feared Nazi bid for world mastery, and the consequential grave implications from permitting it to remain in the forefront of exploiting science for terrorization and destruction.'

Inasmuch as the official history under the A.E.C. auspices included disclosures that the historians had received from Dr. Szilard regarding (a) the difficulties faced by him and colleagues in the then Columbia nuclear research and (b) his own concepts of international intervention to forestall Nazi monopoly of both research and supplies, it would appear obligatory merely than advisable that the original sharer in and responder to the then problems fill out the record.

First as to the personal and group problems, those of us who had been concerned through the trying years in the Thirties about the exiled scientists and scholars had - as already reflected to the reader in the recapture of the Lord Rutherford assistance-activities - connections for channeling private as well as organizational assistance, and so assurances on that score were conveyed to him. Parenthetically, in the modified draft of my proposed letter for Dr. Albert Einstein, the redactor chose to include what I afterwards had to criticize him for, namely that the proposed link between the President and the scientists would have as a second of his tasks supplementing the limited "budget of university laboratories by private funds ... through his contacts with private persons who are willing to make contributions for this cause." Fortunately, the mere intimation that was given him as to potential larger sources was deliberately left by me vague, and so it was included under his inserted description of the tasks for "some permanent contact maintained between the Administration and the group of physicists working on chain reactions in America." The just called "supplementary sources" referred to a discussion of mine with and agreement in June with Mr. Walter Stewart of the Institute and the Rockefeller Foundation for his good offices to secure foundation support.

Then secondly, as to the international aspects that bordered on diplomacy mentioned in the Official History, the proposal - which he had previously voiced to me - that Dr. Einstein, who had long ago met the Belgium Royal Family, should "alert the Belgians ... to keep the uranium ore of the Belgian Congo out of German hands," - that proposal ran up against that, unbeknown to Dr. Szilard, the then King was neutralist, and moreover, such intervention was legally improper for a private American. In this connection, the Official History slips up in involving by name in the latter proposal other physicists and in assuming that the frustration of the transitional proposal ~~with Szilard~~ had anything to do with Dr. Szilard's quest for an approach to the White House.

The foregoing summary treatment of the problems mentioned in the Official History as having then worried Dr. Szilard are left for treatment. The larger problems that stemmed from revisions that Dr. Szilard made in the draft of the Dr. Einstein letter, - that was given by this original proponent of a type of communication reflective of attitudes that both Dr. Einstein and the President had at heart. ~~Subsequent~~ ^{to the} novel mode of the

emergence of newly accruing history and the obstacles encountered, it is necessary to document how the claims in the substitute draft that went beyond the then state of the research - left trailing issues that had to be surmounted. Under the circumstances of this writer's then professional preoccupations, there was no opportunity for visiting his old friend Dr. Einstein and securing a signature for the original draft, by this writer, for which there would have been ample time between early-August and the eventual presentation of the dossier in October. - Yet, while the needed corrections would have pleased Dr. Einstein - as I learned in a much later visit - one had to avoid reflecting on Dr. Szilard's excessive zeal. Therefore, the substitute letter was accepted.

The accompanying juxtaposition of the two drafts will enable the reader to elicit the divergencies and to infer some of the questions that members of the Bureau of Standards did raise. But, though important at the time, they were surmounted and their notation is relegated to an Appendix to the Chapter. It remains to underline that that genius of an experimenter was also of zealous dedication to the cause, and tended to intervene in the flux of international history. Those by experience and temperament attuned to mindfulness for proprieties have to find ways of remaining both appreciators and protectors. (Appendix 2)

Appendices to Chapter VI

Appendix 1 to Chapter VI

Origins of Concern with
Significance of Atomic Bombardment
for U.S. Defense and for
U.S. Role in the Overriding
World Crisis from Beginning of 1934

Weekend February 3 - 4, 1939

Meeting with Frank Aydellote, Director Designate (successor to Abraham Flexner) Institute for Advanced Study, Princeton, N. J. Also with Robert B. Warren and W. W. Stewart at the Institute.

Continued my Cassandra warnings of imminence around the Idea of March new Nazi-timing for aggression by a coup in Czechoslovakia, knocking the pins under the ranshackle Munich "settlement." Testing of ideas of imminent outbreak World War around August - September - in connection forthcoming Report for FDR arranged early March.

The approaching all-encompassing eclipse of civilian life for a most terrible technological war with unspeakable Nazi cruelties coincides in mysterious Providence with hints new scientific revelation through convergent discoveries in atomic physics. Under spell of just received book Background to Modern Science (Cambridge University Press late 1938) which includes the lectures of Lord Rutherford that I had heard in 1936 - With what modesty the late Lord Rutherford calls "the work of Bohr to be one of the greatest triumphs of the human mind." That applies to himself and not only to those giants but to the whole assemblage of workers in Europe on atomic physics, many of whom have been scattered to our country and struggling to get laboratory spots and to pierce the surrounding indifference from the establishment of science research, as already well known from people within my ken among the refugee scientists.

The sequel lecture by P. W. Aston on Forty Years of Atomic Theory concludes with this terrifying challenge: "Personally I think that there is no doubt that sub-atomic energy is available all around us, and that one day man will release and control its almost infinite power. We cannot prevent him from doing so and can only hope that he will not use it exclusively in blowing up his next door neighbor" - What terrible portent if Nazis should get it !!!!!

On return Sunday, February 5, 1939

By strange coincidence the subject uppermost in my mind been found dominant in the whole Institute Community under the impetus and inspiration of Niels Bohr. F. A. showed me copy of a letter written by Niels Bohr while at the Institute bearing the date of January 20, 1939 to the Editor of Nature, entitled "Disintegration of Heavy Nuclei." The letter opens: "Through kindness of the authors I have been informed of the contents of the letters recently sent to the Editor of Nature by Professor L. Meitner and Dr. Frisch." It ends with a plea for "the continuation of the experiments in the new type of nuclear disintegration."

The communication to be published presently refers to the revolutionary accomplishment by two German chemists, Hahn and Strassmann, of atomic fission, and carries this further in the light of their corroborative experiments in the Stockholm Institute.

* * *

Follow-Up Weekend Visit, March 17 - 18 -

At the Institute the since received copies of Nature containing the Meitner-Frisch communication was more of a resounding subject than the fulfillment of my Cassandra forebodings voiced in my early-February visit. In the same Nature for February at pages 239-40 there appears the letter-type of communication under the heading "Disintegration of Uranium by Neutrons" by Meitner and O. R. Frisch under respective academic auspices in Stockholm and Copenhagen. Interestingly, the same issue contains a leading article which features the Hahn-Strassmann experiments of the turn of the year, 1938-1939, based on two reports in Naturwissenschaft: "'Isotopes of the Alkaline Earth Metals from Uranium." The issues received also contain report by Professor Otto Hahn and F. Strassmann: "Chemical Properties of the Trans-Fission Elements."

Read the paper which had the sympathetic audience of the Chief - the prior week and which had been presented in full before the same St. John's College on March 10th. Alas, confirmed on the Ides of March through the Nazi seizure of conservative Prague Government and the introduction of a mere satrap, Hacha. The address which became the center and circumference of the Institute conferenciings is entitled "Imminence World War in Perspective Accrued Errors and Cultural Crisis of the Interwar Decades." The emergence of the new crucial scientific experimentations needs to be brought to the Chief's attention, but he must remain preoccupied with the shadow activities on the assumption that war Menesis is avertible - and then will have to remove the self-imposed shackles of the Neutrality Act.

* * *

Further Visit with R.B.W. and F.A., Weekend April 21-22, 1939

The Princeton community continues to resound with new disclosures in the scientific world through the medium of Nature. The issue of March 18th contains another communication from L. Meitner and O. R. Frisch entitled "Products of the Fission of the Uranium Nucleus." The sensation of the issue, however, to the scientists of the Institute and Princeton University, especially the refugee Professor Wigner, is the communication from the Joliot-Curie group. His collaborators as listed are Dr. L. Kowarski and Hans von Halban, Jr. (the extraordinary mixture of man-of-the-world, well-married to a Rothschild and inventive experimenter). Their communication from the Radio Laboratoire de Chimie Nucléaire is entitled "Liberation of Neutrons from the Nuclear Explosion of Uranium." Wigner thinks the Joliot-Curie group farther advanced than any in the world - in view of Fermi's continued skepticism about reinforcing cumulative energy processes.

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APPENDIX TO CHAPTER VI

On the First Draft of a Letter by This Author and on the Substitute Draft
for Dr. Einstein's Communication to President Roosevelt and Some Resultant but
Surmounted Problems with the Bureau of Standards

On examination of the Substitute draft, with juxtaposed reproduced texts, the reader will be struck that in the second paragraph after the mention of the possibility "to set up a nuclear chain reaction in a large mass of uranium" Dr. Sillard transposed it into a high and nearly probability: "Now it appears almost certain that this could be achieved in the immediate future."

Now while recognizing that Dr. Sillard, along with the French experimenters and the later more important group of British experimenters, personally felt convinced, still his assertion took a time-leap ahead of available evidence, - indeed the evidence was deferred until that historic demonstration by Dr. Fermi and his group in December 1942. So the above assertion - in which Dr. Fermi definitely did not consent as "almost certain" - met with severe criticism communicated to the White House by physicists in and head of the Bureau of Standards. In their conveyed criticism via General Edwin Watson to the President, it was also questioned how Dr. Einstein, detached for so many years from experimentation, could have gotten himself to make or to endorse such a claim, and they wanted to be able to ask him directly. As for the next assertion in the text that linked a bomb to "exploding ports and surrounding territory", that was thought to have neglected the more important danger to populations, and my point that the Nazis were masters in advance claims for generating fears.

Finally, the concluding paragraph was severely attacked for letting the revered scientist and humanitarian make a claim regarding what was going on in the obviously secret and inaccessible laboratories of the Kaiser Wilhelm Institute in Berlin, especially for presuming to report that in that Institute "some of the American work on uranium is now being reported."

Draft Letter to Mr. President, August 1945

6 No. of 1st Street at Wash DC

45 Dr Morris College, Pacific Heights

Dear Mr President:

It is to you who has come to cherish the
fraternal quest of the original Pilgrims and share
the similar quest of this decades new pilgrims
from persecution to the "life and liberty"
of this country that I beg your consideration
by this and the rough, once common, word
of an special discovery, which bears

on U.S. security. At the turn 1936-39 the search
in which the democracies, including scientists -
refugees from Nazism and Fascism, have
led L. Eliot in an experiment in Germany
that effected the split or fission of the atom,
entailing in the process unprecedentedly tremendous
energy. Thus has been raised the grave
question of possible discovery of ways to harness
that power, in part a substitution for evil
as for good the fruits of the Tree of Knowledge

In the course of over four months work -
led by E. Fermi, Nobel Laureate in atomic

physics, and L. Szilard, from Germany via England, and
with work by F. Joliot and colleagues in France,
and Britain and Scandinavia new vistas

have been opening on setting up nuclear
traction towards the production of the in
reactions. In the favorable event it might
lead to the construction of atomic bombs,
by plane or boat

by granting the not yet advanced stage
of the research the accelerated tempo
of the burgeoning experiments and
the onrushing war danger in Europe.

The human and material resources
involved seem to me to be
being concentrated in
The opportunities
The unbalanced weapons have been
consistently against the democrats
Taking time by the forelock
across the new frontiers of
would give by product of military
and the military and the
atomic field.

On the source material I am informed
that uranium is made in Germany
and in France in great quantities
and in fact and good supplies
The largest and most important source
is the Belgian Congo, a storehouse of uranium
Without presuming to deal with
matters of organization permit me
to say that the progress of your
efforts in the field of atomic
energy and in the progress
of French research in the University
is not as handicapped in their
efforts by the economic decline and
the loss of funds from the slow economic
growth as let by our friend
France in Germany in Germany
research in the field of atomic
energy.

My notes recall following of these
phases of atomic physics in France
and the European development
advise me that Germany has taken
the uranium mines in Czechoslovakia
and stopped sales and exports. Arrangements
for Canadian and Belgian source
should be made. And to crucial research
issues I am large governmental and
corporate industry and institutions interested.

EXHIBITS TO CHAPTER VI

REPLY IN DUPLICATE
AND REFERENCE TO

WILL BE APPRECIATED

NAVAL RESEARCH LABORATORY

ANACOSTIA STATION

RG/ejh

WASHINGTON, D. C.

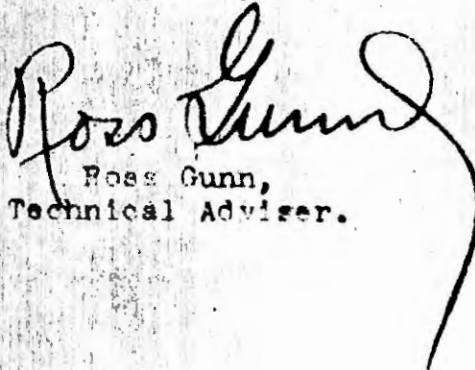
10 July 1939

Dr. Leo Szilard,
Department of Physics,
Columbia University,
New York, N.Y.

Dear Dr. Szilard:

The matter which we discussed at the Princeton meeting of the Physical Society has been carefully considered. As I indicated to you at that time, it seems almost impossible, in light of the restrictions which are imposed on Government contracts for services, to carry through any sort of an agreement that would be really helpful to you. I regret this situation but see no escape. We are anxious, however, to cooperate with you in every respect and appreciate your assistance on this important problem.

Very truly yours,


Ross Gunn,
Technical Adviser.

CHAPTER VII

Arranging for Systemic Cognisance and Furtherance by the President Under a Science-Oriented Agency of the Progressing Atomic Research: With View to Accelerative Decision on Defense Applicability and Governmental Implementation

A.

As the closing section of the preceding chapter described the situation in atomic research in the summer of 1939 and the plan that was evolved by the writer in the course of conferences with Dr. Szilard for continuing and augmenting the research activities by the Columbia team upon entering the new academic year, the next phase starts from the arranged meeting with the President at the White House on October 11, 1939. The submitted letter concurrently with the conference - as previously explained for the assurance of co-consideration of points raised - opened by referring to the removal of the hurdle from the Neutrality Act and the consequential opportunity for his concentrating on defense. The letter read to him contained themes that have been accorded in the foregoing chapters' more detailed explanation and documentation. Thus, it was stressed that in the then already progressing Nazi war for domination science and technology have become urgent prerequisites for defense-adaptation.

"The scientists are mindful of the implications of all this for democracy and civilization in the historic struggle against the totalitarianism that has exploited the inventions of the free human spirit.

"As the international crisis developed this summer, these refugee scholars and the rest of us in consultation with them unanimously agreed that it was their duty as well as desire to apprise you at the earliest moment of their work and to enlist your cooperation.

"In the light of the foregoing, I desire to be able to convey in person, in behalf of these refugee scholars, a sense of their eagerness to serve the Nation that has afforded them hospitality."

The letter concluded with a request for further conferences (a) on sources of uranium supply and (b) on "continuous liaison with the administration and the Army and Navy Departments", and (c) for "solving the immediate problems of necessary materials and funds."

That first conference was followed up the next morning by a more

intimate conference in which references were made to the already known disinterest of the Services in deflection to pioneering pure science when the urgencies were for adequacy of already known and tested weaponry and materiel, inasmuch as the Nazi successes in and aggressions were mediated by the volume and the mobility of mechanized weapons and trained personnel. This was transposed to a non-professional plane suitable to an advisor known as familiar with scientific and technical publications. He, therefore, ventured to conjecture that though military experts in the west have not yet given specifics on what the Germans and their propaganda called their secret weapon, it would be reasonable to assume that the Nazi dedication to Wehrwissenschaft and Wehrwirtschaft would be prosecuted with a speed and zeal greater than what would be the case for the Allies, in view of the prolonged neglect of defense by the countries which were our allies in World War I. Therefore, the U.S.'s sheltered position for the present and the very availability in the U.S. of the refugee-scientists in atomic research constitute a unique opportunity. Towards the end of that breakfast conference the advisor recalled how in his student days, before World War I, it had been vouchsafed him to hear from the Reverend John Neville Figgis, one of the executors of the great historian Lord Acton, an episode regarding Napoleon's insensitivity to the value of science: after the failure of Napoleon's attempt to cross the Channel he was visited by Robert Fulton, who proposed support for and application of the steamboat for overcoming the turbulent tides and currents of the English Channel. That lack of imagination to entertain a new idea sealed Napoleon's fate. - The moral did not need to be elaborated.

Out of the reinforcing conferences came the President's instructions to his secretary, General Watson, for considering the advisor's proposed new arrangement and putting it into effect. The arrangement was to detour the whole problem from the Armed Services to the Bureau of Standards, for after all, its scope of activities includes problems in physics and the instant task is evaluating the newly attained

phase in atomic research in the Columbia University's Department of Physics and providing for that team the means for effectuating quickly the expected next major stage of the research.

Supplementing the foregoing, which was long ago put into history - by the writer's Testimony at end 1945 and by the Look article in March 1950 - the occasion of the visit to Washington was utilized for securing firsthand "intelligence" in the British sense of the word, from the new British Ambassador, Lord Lothian, as per the telegram to him on October 11, 1939 for an appointment. (Exhibit I and 2)

Having ~~stepped~~ from the assumption of administrative and executive task in order to maximize the functions of independent thought, diversity of access and the most thoroughgoing confidentiality to the President the intensified link with Lord Lothian - as an accepted but totally undesignated worker in the common cause - enabled the writer to be the bearer of what at the time was the first formulation of "the British need for cruisers and destroyers." It was in a meeting at the Embassy on June 1st - or on the eve of our conventions and the attendant ferment over the positions that might be taken by the opposition party in favor of neutrality - that the Ambassador remarked that he would like to speak his mind as between friends united, as he expressed it 'in transcendent purpose and transcendent urgency.' So I asked him whether such possible function as I might perform would not be better if I took notes instead of just listening. He agreed and that was my afterwards transcribed and condensed page and a half. (Exhibit III) Just as after performing the message-carrying role to the President it served as a prelude to the case that I had argued from May on for the subsumption of the Atomic Project under a new organization for scientific research and development (as per the closing pages of the revised transcript of my Testimony and the corresponding accounts in the official history), so in the sequel to that meeting at the Embassy I was able to learn of the developments since the history-making Frisch-Peierls Memorandum in the early spring of 1940. The Memorandum itself needs deep and grateful recapture, for by their theoretical reasoning that duet

(a) foreshadowed critical size of the bomb, (b) suggested method of detonation, (c) method of U-235 separation, (d) warning of radiation effects from the explosion, (e) averting premature explosion through a suitable structure and (f) even as to separation of the U-235 that team proposed a system of thermal diffusion. It is from comments that were made in the second quarter of 1940 in the transmitted intelligence that the foregoing features were emphasized. Above all, it was the support of Sir James Chadwick, as esteemed on this side as in his own country, that was a message of reassurance for transmittal to the Chief. The material from London as reviewed also indicated that Sir James Chadwick (as he came to be known later) thought that the cross section measurements by our own highly esteemed physicist M. A. Tuve of the Carnegie Institution for the critical mass of U-235 need not be anywhere near as large. Between the mid-second quarter and the end of the late summer the Maud Committee was formed under the strong leadership of an eminent group of physicists - with Professor G. P. Thomson as chairman and the quintet of Chadwick, Cockcroft and Oliphant, P.P. Moon and Blackett. As new experiments soon ensued, the role of the British scientific attaché in Washington, Professor A. V. Hill, became the more important.

A leading figure in the experimenting under the Maud Committee was the then Franz (made Sir Francis after the war) Simon, who personally was very close to the most intimate advisor of Churchill, Professor Lindemann, afterwards Lord Cherwell. For the conversion of Lindemann the added services of Professor Peierls was secured. Then came the French team of Drs. Halban and Kowarski. By the end of the summer they were attached to Drs. Bretscher and Feather of the Maud Committee.

In the closing third of the year 1940 the most fertile theoretical thinking keyed into imaginatively discerned practice was done by that original team of Peierls-Frisch for Professor Thomson as chairman of the Maud Committee. Together with a covering summary that team produced ten papers of mathematical explication and practice adumbration.

A pivotal memorandum - again according to contemporary evaluation by specialists - deserving top rank was that by Dr. Simon in December 1940, as a crystallization of the labors of the Oxford Group. It was called "Estimate of the Size of an Actual Separation Plant." It highlighted the application of the principle of diffusion through membranes for the project for handling the enormous quantities of U-235 separation on an industrial scale and to be accomplished in a reasonably short period, namely from one to one and a half years. The conclusion of the paper condensed from notes expresses: "Confidence in separation along line described and that the scheme would be not unduly expensive of time, money and effort."

* * *

The foregoing summary description of scientific thought and experimental work by members of the British teams of researchers has been submitted herein not as a resumé of concurrent labor but rather for its impact upon the partly contemporaneous and partly later labors in the US. For the much earlier focusing of the scientists connected with the MAUD Committee on bomb construction exerted an influence on those in the US group who still put the emphasis on power as distinguished from weapon. Thus the Official history of our Project by the Atomic Energy Commission published in 1962, in the sub-section of Chapter 2 called "Research: The Chain Reaction," states:

" ... American scientists saw it first as a source of power. All of them, certainly, had thought of the possibility of a bomb. Some believed that in achieving a chain reaction they might gain understanding of what it took to make a bomb. But scientists in America did not direct their thinking primarily toward a weapon. When Pegrum and Fermi outlined the research plans for the Columbia team in August, they listed their objectives only as power and large amounts of neutrons for making artificial radioactive substances and for biological and therapeutic applications." (p. 27)

Accordingly, the divergence in objective for the research has been featured herein not for the purpose of grading the two efforts, but rather for the purpose of emphasizing the then need for what might be called 'asking the right questions for the right objective as the state of technology expected to emerge from the research.' -- For sharpening the illumination upon the issue of culminative use, it is fitting to recall a passage in the British Official history, published two years after the American Official history, - a passage pointed to this very matter of the 'right and important new question':

"The questions may seem obvious enough today but they were not at the time. In America they were not asked for many months, until after the British work was available. The German physicists, including the brilliant Heisenberg, apparently did not ask them at all."*
(M. Gowing, Britain and Atomic Energy, 1939-45, p. 42)

* A detailed report on that is given in Chapter 24 of General L. R. Groves' Now It Can Be Told. (1963) It even states that in the aftermath of the War, certain eminent captive German scientists had disbelieved when they had heard the news of the Hiroshima bomb.

May 24, 1968

SUBMITTED INSERT IN CHAPTER VII AT PAGE 7 AS NEW SECTION B
REQUIRING PRESENT 'B' TO BE CALLED 'C' WITH ENSUING SECTIONS AT
RESPECTIVE HIGHER LETTERS ALPHABET, AND MATCHING CHANGES IN NUMBERED PAGES

B.

Recapture for First Time Unique Value Bureau of Standards as Investigative
Vehicle for the President, After Armed Forces'
Express Disinterest in Atomic Project

In this distinctive transcribing from the preserved logbooks of the experimental courses that were followed by the intimate advisor to President Roosevelt in the launching of the Atomic Project, our concern in this section is with the definitive negative attitude of the technical heads of the Armed Services - particularly the Navy which alone had a research organization - towards requests as early as the spring of 1939 by the Columbia University Physics Department for support of atomic research on the possibility of technical development. The first proposal to an appropriate governmental military and technical organ was made on the 16th of March 1939 by Professor George B. Pegram, head of the Physics Department of Columbia, to Admiral S. C. Hooper, Director of the Technical Division of Naval Operations, requesting his seeing Professor Fermi with regard to the mere possibility of uranium's liberating multifold "energy per pound as any known explosive".

In that very context the author of the letter recorded his "own feeling that the probabilities are against this" and the great experimenter, Professor Fermi, reenforced that judgment. And as was disclosed fifteen years later by Laura Fermi, at that particular time her husband held and declared - as recalled by him ten years after that visit - that "there was little proof that we were not pursuing a chimera" (Atoms in the Family, 1954, page 162). To near contemporaries, such as that other great collaborator in the Project, Professor Arthur Compton, it appeared two years after Laura Fermi's book that the Navy's disinterest might have been related to (a) "super-caution" by Professor Pegram and (b) the Navy's reaction to it in "not understanding that for an academic scientist even to make such a suggestion meant he considered the matter of urgent importance" (As noted in A.H. Compton's Atomic Quest, 1956, page 26). But if at the time of writing Professor Compton had

at his disposal the exhibit included in the preceding Chapter herein, namely the express turn-down by the technical advisor, Mr. Ross Gunn, to the Naval Research Laboratory on July 10, 1939, he would have realized the Navy's rejection of aid stemmed from the then (a) official policies and (b) also "restriction which was imposed on Government contracts". For these reasons that letter concluded, "I regret this situation but see no escape." The early reply by the Navy to the Pegrum-Fermi submission was an expression of thanks for having brought the matter to their attention and an expression of hope that they will be "kept informed regarding further developments".

In fine, contrary to the assumption by that cherished great collaborator in the Atomic Project - embodied in the subsequent publicism and literature - that initial delay did not come from faulty communication. And in point of historic fact/^{it} was followed by numerous interposed obstacles, which required sustained labors by the President and his advisor over the long period from 1939 through 1941. Even if the then or the long persistent attitudes of super-caution had been replaced by the very opposite, - say in the form of a ventured sense of high probability of "nuclear chain reaction" as entertained in early 1940 by the scientific refugees to Britain - the problems of enlistment of support from the Executive with concurrence by the Armed Services would have remained, as documented in detail herein. The original recoil in March 1939 by the appropriate organ of the Armed Services from fostering and from supporting the atomic researches, stemmed from poignant awareness and worry by the Naval and Military authorities about National Defense in the sense they understood it, namely the aggregate of tested weapons, established installations, and sizes of Armed and Naval forces. For that day of the interview with Admiral Hooper, of Naval Research, by Professor Enrico Fermi, as the representative of the small Columbia group of atomic physicists, was the Ides of March 1939 when Hitler had taken total military mastery over Czechoslovakia as prelude to aggressive demands on Poland and then prelude to war.

Though that sequel to the Munich Settlement in the prior autumn of 1938

had been forecasted by this advisor and re-reviewed in the March 10th Memorandum on "Imminence World War" with a culminative plea for immediate U.S. preparedness, the neutrality-mindedness of the Senate and large parts of the public since the legislation of the mid-Thirties was still so potent that the Senate, under the influence of Senator Borah, resisted and resisted all efforts by President Roosevelt and Secretary Hull to effect at least that revision which would have permitted prospective victims of German aggression, allies of ours from World War I, at least the access to purchase for their own cash in the U. S. the military supplies, which could also have provided mitigation of our then still very large unemployment. Only after the outbreak of war and the Blitz-Conquest of Poland by the Nazis was the President enabled, with a bare majority, to overcome prior resistance by the Senate to his plans for the revision of the Neutrality Act!

But across the thus sketched portentous obstacles which had foreclosed the Armed Services aiding and fostering atomic research, there had been operative that continuity of interchange with the President on the crucial developments between the lectures of Lord Rutherford and F.W. Aston at Cambridge through the post-Munich effectuation of atomic fission as properly interpreted in Scandinavia and conveyed by Niels Bohr to the American physicist. The President and all close aides were throughout the long arduous labors from spring 1939 dedicated not only to revising the Neutrality Act but establishing that National Defense for the U.S., corresponding to the magnitude and speed of the German aggression ahead. In that setting, the fostering and the aiding of atomic research was envisaged by the advisor as inaugurable after the removal of the obstruction to the revision of the Neutrality Act and as capable of release and development in connection/ ^{with} continually requisite restoration of economic recovery and full employment through the previously advocated special stimuli from scientific research and applications.

On this orientation the advisor's approach was to utilize that Agency

of the Executive which from the mid-1930's on had been concerned with the role performable by scientific research in promoting economic expansion. The then Director of the National Bureau of Standards, Lyman J. Briggs, who had been appointed in the culminative depression year of 1932, was seeking not only relief from the budget cuts during the depression, but became protagonist from the mid-Thirties of a new career for that Bureau as governmental fosterer of "basic research in physics and chemistry in order to provide the foundations for new industries" (to quote from a later address of his before the American Engineering Council on "The Place of Government in Research," November 11, 1938). This attitude and theme harmonized with this Presidential advisor's critique of the converse theory of a structured American "economic stagnation", as was then propounded and propagated by the Harvard School of Economics under Professor Alvin Hansen. President Karl T. Compton of the Massachusetts Institute of Technology, as then also Chairman of the Science Advisory Board to the Bureau of Standards, was also stressing "the Government's Responsibilities in Science" (in an article in the spring of 1935, Science, Volume 81, April 12, 1935, 350f).

The initial 1935 draft was finally presented to and became the 75th Congress' Bill H.R. 7643 (June 23, 1937). The Bill's aim was thus defined: "To provide for further development of industry and commerce through research in the physical sciences and to promote industry and commerce through business research." According to its terms the Bureau could allot up to half of the funds to be appropriated by Congress to universities and other nonprofit research agencies for specific projects.

The ensuing emergence of competition from other Government Departments and Agencies, along with objections on account of economy by the Bureau of the Budget, delayed action by the Congress even though Science Associations and the Business Advisory Council and also the President, supported that Bill. Towards the culmination of the national economy's expansion phase from mid-1935 to mid-1937 a variety of bills were accorded hearings by the House Committee on Interstate and

Foreign Commerce from late-July that year. But though Mr. Briggs brought endorsements from such prominent men as Arthur Compton, Robert Millikan and Harold Urey, legislation was deferred. After suspension of consideration in the recession phase of the economy the first half of 1938, the opening of the next Congress, the 76th, in the international crisis year of 1939, witnessed reintroduction of the prior Bills with some technical changes.

In mindfulness then of these approaches and efforts by the Bureau of Standards with the support of eminent leaders of American science, this independent counsellor to the President of programs for economic revival and new economic dynamics for the U.S. decided on utilizing the Bureau of Standards as the vehicle for the preliminary investigation with a view to judgment on Governmental fostering of the Atomic Project. Thus the negativism and the adverse actions by the Naval and Military research authorities were more than detoured, and, far from running the risk of challenges from them, individual representatives of both Services, were included as advisors to the technical group of the Bureau of Standards. Through the President and his aide, General Watson, the Director of the Bureau of Standards was led to conduct a series of conferences dominated by the advisor's recommended list of then leading figures in experimental atomic research. Concurrently the Bureau of Standards' promotion of special legislation was allowed to undergo consideration by Congressional Committees during the final stage of American neutrality. The Congressional sponsor of that closing version of the Bureau of Standards Bill, Clarence Lea of California, in his turn asked for the opinion of the then President of the National Academy of Sciences, who responded by drawing attention to questions on patent provisions, though President Karl T. Compton of M.I.T. gave the Bill his endorsement. Dr. Vannevar Bush stressed the shortcomings of the patent provisions.

But that closing year of its consideration in 1941 had already become anachronistic by reason of the establishment as described herein by the Presidential Order of June 1940, following the advisor's recommendation in May, of the National Defense Research Committee. That Committee in official charge of weapons research

had already been working for better than a year on the Atomic Project. Through the stages to be described in the remaining sections of this chapter, the originally devised conferring and deciding organ under the auspices of the National Bureau of Standards had totally eclipsed and obsolesced the Bills that were under consideration by Congressional Committees.

But the superseding of the then Lea Bill by the prospectively tremendous complex of projects, that interlinked pure research and discoveries in atomic physics with applications in technological national defense, brought into much larger and deeper fulfillment than had initially been discerned in the activities of the National Bureau of Standards in the post-Depression decade for the Federal Government's intervention and for the Bureau's effort for instituting and structuring Government's Support of Scientific Research and Scientific Applications for Promoting Industry and Commerce (and Economic Expansion) (as per the declared preamble of the first Bill to the 75th Congress, First Session (H.R.7643), introduced on June 23rd, 1937). Out of the association between the advisor and the President in the surmounting of the obstacles to economic recovery and economic progress came the common orientation for radical departure from and substitution for the then fashionable but unconstructive theory of 'Economic Stagnation' and 'End of the Economic Frontiers' - with limited influence on ^{and} some echoes in that huge project which passed in 1939 called the T.W.E.C. Economic Investigation, as carried out in extended Hearings and Monographs, that were only completed in late-1941. The substitute of the atomic research and the atomic weapon was at first ^{against} mediated by the Bureau of Standards - as / the disinterest in aid by the research organ and leaders of the Armed Services -, and that role came naturally ^{to it} / and inherently fitted it by the very reason of its efforts from the early-Thirties into the overlap neutrality years. for innovative proposals to the Congress in behalf of scientific research and development. Thus it served as a framework and a catalyst

vehicle for the overture phases of continuing and aiding nuclear research and the crystallization of plans for the later eventuated demonstration of so potent a chain reaction as to highly probably predetermining the application into an Atomic Bomb. Coordinately, the scientific and administrative personnel that was repeatedly called in to comment on the successive Bills was later on presented on the enormously larger and more diversified scales of the Atomic Project. Yet, the President through the advisor, who helped overcome and transmute the original obstacle from the foreclosure of the normal military channels, remained dedicated to the basic concept of those Bills, viz. the distinctive and creative role of the Federal Government as a fosterer and distributor of research and development for the then and since corequisite ends of National Defense and at once dynamic and sustained economic prosperity.

Thus, in furtherance of the initial and maintained dual objectives, to wit: National Defense and peace-time productivity of science for National Prosperity, there came before the end of the War - out of a body of thought represented by the exhibits to Chapter II included in this Report - President Roosevelt's letter to Dr. Vannevar Bush, head of the OSRD, with requests for the continuance and the transposition of that monumental experiment to the postwar life and career of the American Nation. The national principle and the national ideal, as formulated at the conclusion of that letter of mid-November 1944, was utilized by Dr. Bush in his reply of July 5th, 1945 sketching forth an at once farsighted and detailed agenda of national tasks. The President's advance request of November 17, 1944 set forth the policy for the continuance of national activities in sustained fulfillment of the dual objectives. And as that was used by Dr. Bush in that reply of July 5th, 1945, as epigraph for his long report on "Science - Endless Frontier", it is at once appropriate and advisable to recapture that policy, formulated at the conclusion of what in the eventual canonical history of the U.S. will have to be accorded the special role

of a Founding Document for our Nation.

" New frontiers of the mind are before us, and if they are
pioneered with the same vision, boldness, and drive with which
we have waged this War, we can create a fuller and more fruitful
employment and a fuller and more fruitful life."

Old Section B of Chapter VII will now become "C" - pages 15 - 16

Old Section C of Chapter VII will now become "D" - pages 16 - 17

Old Section D of Chapter VII will now become "E" - pages 17 thru 19

Old Section E of Chapter VII will now become "F" - pages 19 thru 24

B.

Restricting ourselves to etching-in lead-strokes, rather than full portrayal, this close lay-reader of the literature, with aid from professional physicists, believes that the year 1939 can be summarized from year-end review by Prof. L. A. Turner. The consequential pivotal role of a chain reaction was for the preponderance of the researchers realized as difficult but not unequivocally impossible or, on the other hand, probable. The besetting uncertainties were set forth in ~~the~~ review-article at the turn into 1940. (L. A. Turner, 12 Rev. Mod. Phys. 1)

For all the series of conferences in the United States - for which in a personal capacity to the President this writer was rapporteur - through the spring and up to May 1940, Dr. Briggs and the Bureau's scientists were unsatisfied with the progress by the Columbia group to demonstrate the feasibility of explosion-productive chain reactions. Coordinately, almost overwhelming pressures from the military services were operative on the President to concentrate on ordinary defense. To avoid decline in the President's interest, the proponent proposed, in a letter of May 15, 1940, the establishment of a scientific organization for clearing and supervising not only acceptable military weapons but experimentation looking to new weapons. This Office of Scientific Research and Development was formally enacted on June 15, 1940, through a coordinating committee for all scientific efforts connected with national defense.

The slowness in the emergence from the Columbia group of proof of feasibility of an atomic bomb led to Dr. Bush's arrangement with the then President of the National Academy of Science to review in the spring of 1941 the Universities' programs and practicability. Then just as a sub-committee under Arthur Compton of the University of Chicago was considering at the beginning of June alternative moderators, a returned American physicist from a mission to England informed them of the enormous progress that he thought was being made in Britain, including work on isotope separation and gaseous diffusion at Oxford by the then Franz Simon, one

of the refugees, who after the war was knighted and became Sir Francis Simon. And a month later when Briggs of the Bureau of Standards was still pressing for arranging a new experiment on chain reaction with a modest grant of under \$200,000. the (British) MAUD technical Committee had already accepted the April report by Rudolf Peierls that efficient cross-section of U-235 would lead to a bomb of tremendous power. That British position was almost fully accepted by the National Academy in its report to Dr. Bush, as is admitted by the authors of the authoritative Atomic Commission's Report: "Though more conservative than the British recommendations in highlighting uncertainties, it (the National Academy Report) confirmed the conclusions of scientists in England that Uranium-235 could be supported and made into an effective bomb."

C.

In the result, President Roosevelt by the end of June - precisely on June 28, 1941 - was moved to cut the Gordian Knot and to differentiate responsibilities by establishing by Executive Order, under Dr. Bush's main direction, the Office of Scientific Research and Development, while leaving Dr. Conant in charge of the Defense Research Committee.

In historical sequence, the crucial turning-month was July 1941, right on the heels of that June 28th Presidential establishment of the O.S.R.D. The decisive authorization for expenditures came still later, on October 9, 1941, when that was conveyed to me. It was and has remained mentally ticketed, in the words of the original notation, as "just about two years after my formal presentation of the Project to the President and the President's initial conversation by me to the Project." That conversation merits re-designation and re-emphasis by reason of the uniqueness of his role in the Project's history, namely return of the Presidential Office to a concept of science-promotion that Thomas Jefferson and the other Founding Fathers had at the inception of this Federal Republic. Though professional historians,

as distinguished from biographers, are chary about featuring emotive ideals, the President was not only susceptible to but impelled by emotive ideals and idealistic emotions. Inasmuch as his already entered-upon Third Administration was part of the slow readjustment to the legacies of the great and deep Depression, the idea of returning to a synthesis of scientific and economic progress appealed to him as a new manifestation of that distinctiveness of the U.S. represented by the Great Seal, which describes the new Republic as "Novus Ordo Seclorum."

D.

Clearly, then, the first half of the year 1941 revolved around the task of overcoming diversified opposition by influential scientific and governmental groups to pursuing with the Atomic Project in advance of definitive proof of practical adequacy in magnitude of chain reaction. These sources of opposition in one conference evoked from the President the idea that they were analogous to "men of little faith," mentioned in Matthew and Luke. The recollection by a Bible reader of originals alongside translations elicited a comment on the derivative of that expression. After checking it was later supplied that the New Testament Greek expression "oligopistoi" was from the Hebrew "ketanei emunah." That first original it was suggested, is translatable as 'petty-ones in faith'. Such asides for that tremendously burdened but luminously single-minded President served at times to recharge his interest and to thence transmit it to the Project's administrators.

In consequence, the President re-urged the high officers of the O.S.R.D. to bring the counter and constructive British views to bear upon and to disprove the objections and dispel the objectors. Thus, too, from mid-1941 on, - as shown much earlier from an extract of the official history - the President's "go-ahead" signal to that sagacious administrator, Dr. Bush became operative - in a setting that for us was the already inaugurated war.

For from May 1941 on, or the operativeness of Lend-Lease, that as a

concept was first suggested by this original proponent of the Atomic Project, the U.S. was being invaded by Nazi submarines from near the Gulf ports to the Atlantic Coast ports. And in the ^{later part of war} perduring crisis from our ship losses, which seemed to occur faster than we were building, still another idea, which had been formulated by this proponent in collaboration with a great technologist from German General Electric, was brought into operation by the President in a directive to the Hon^{ble} Lewis W. Douglas, then concerned with war shipping, namely ^{the} the Radiosonic buoy, as a long-advance warner of submarines approaching ports of embarkation and ports of delivery.

* * *

In the sequential stages of the Atomic Project the siege-condition of England from 1942 on and its almost single-handed prosecution of the world-wide war in 1942, until the building-up of our own military establishment, - these militated against Britain's raising the pitch or even maintaining the pitch and scope of the Atomic Project. Moreover, once the U.S. started rolling along under diverse university, military and other auspices, the problem of integrating extra-American participants into activities so highly charged with security implications proved unmanageable. Thus, the British role was transposed to that of periodically called-in "trouble shooters," as on the late stage of the diffusion process and metallurgy. Different individuals rather than teams were in advisory rather than operational association in different parts and places of the work.

The limited and irregular utilization of these scientists - in marked deviation from their assumption that the Quebec Agreement between Churchill and Roosevelt amounted to some kind of a partnership - intensified the sense of frustration. The postwar evaluation by some of our prominent figures in the Project's management has rather deflated the value of the British contribution during the war. On the converse side, the British official literature has been consistently admirative

of the resourcefulness, quality and speed of the American achievement.

In this University setting and for this occasion it is fitting to recall the tribute paid in Britain's Official History by the Cambridge Team to "Fermi's experimental work as particularly beautiful." (Britain and Atomic Energy, 1939-1945, p. 130, 1964)

E.

As we have continually sought to accord greater emphasis on themes and trends than on strictly sequential chronology, the reference in the foregoing to the reorganization of the Project, after our becoming a combatant member of the war by 1942, requires highlighting the processes in the prior year, 1941, for the coordination of concepts and tasks. Such moving back and forth on the line of calendar-time has been found necessary^{also} in and for the Official History of the Project. Thus the section which opens on page 27, entitled "Research: The Chain Reaction," speaks on the following page about a development "by the spring of 1941," and at the end of the ensuing page, 29, speaks of "the big change in the uranium program after June 1940." The common need for such time-crossing items from the differing careers of the respective 'themes and trends.' In further illustration, the Official History, after the above-mentioned subjects, proceeds to review at great length, for a dozen and a half pages, the interventions by a few then marginal members to bring about what eventually became the above-designated "reorganization" of the Project. In its own words, "The central figure in the growing discontent was Ernest O. Lawrence"; and what impelled him was the "then darkening war situation." (p. 33) In the wake of discussions with Ralph H. Fowler, the British scientific liaison officer in Canada, he found that the spectacular discoveries in his California Institute at Berkeley of Elements 93 and 94 - via his cyclotron - heightened the

prospects for accelerating the Project, - the more so because, according to Fowler, that duet in the Cavendish Laboratory at Cambridge, Feather and Bretscher, had also become interested in Element 94. Accordingly, Karl Compton conveyed to Vannever Bush the report, as stated in the Official History, that in the pair's opinion "the British seemed farther ahead despite the fact that American nuclear physicists were 'the most in number and the best in quality.'" (p. 35) What was more disquieting to both was another recurrence of fear about German progress. All that was contrasted with the too slow functioning of the Committee on Uranium under Dr. Briggs. Thus the confluence of scientific progress with worry about the war invested Lawrence with a role of revitalizing the Project, analogous to that which earlier in that history was attributed to the writer (in the form of the incisive comment on page 23, "Sachs had no intention of leaving everything to Briggs"). After the lapse of not quite a quarter, the Karl Compton Committee, having been galvanized in mid-March by Ernest Lawrence, was further stimulated by a returning Harvard physicist from a mission to England in behalf of our National Defense Research Committee (MDRC). The message he brought was that the British thought it was possible to develop an explosive from atomic fission under chain reaction within two years. He also reported that the leading figure in both isotope separation and gaseous diffusion was the very Franz Simon at the Clarendon Laboratory in Oxford to whom we have recurrently referred earlier.

This induced Karl Compton, in a report to his Committee, to promote a strongly intensified effort over the next half year. Since the development of a weapon could come only after the attainment of a chain reaction and would require at least another year, the earliest date set for the weapon was 1943. There was still a sense of hesitancy about timeliness of availability for

a bomb of enormous destructive power - for which a considerably longer timespan was set, since separation of adequate amounts of U-235 might require three to five years. But if Element 94 - a potential substitute for the lighter uranium isotope - could be produced abundantly in a chain-reaction pile, then bombs would be available in a shorter period, though the Compton group did not anticipate such atomic explosions before 1945.

Yet that report was regarded by the then Director Bush and the National Defense Research Committee as lacking documentation and precision in the estimation of time-schedules. Therefore it was turned over to an enlarged Committee of the National Academy under the chairmanship of W. D. Coolidge. That Committee's report in mid-July 1941, while optimistic on the chain reaction in natural uranium, took little cognizance of a nearly concurrent memorandum from Ernest Lawrence on "Fission of Element 94," though it was attached as an appendix. (p. 39 of Official Report) Concurrently, Briggs for his Committee was working on a budget of requirements for the new year. While the budgetary plan "showed clearly the influence of British thinking," it too took inadequate cognizance of the contribution of Element 94.

It was at that juncture that the President's concern for the at once slow pace and inadequate coordination was moved to reorganize on a centralized basis the prospectively interactive scopes of the research for defense that could merge into war. Parenthetically, we need to recall the observation much earlier in this report that our then Lend-Lease shipments were being attacked by German submarines from the Gulf ports to our Atlantic ports to Britain. Under his new powers, the President established on June 28, 1941, by Executive Order, the Office of Scientific Research and Development, which was put under the direction of Dr. Bush. Within it rather than under it was put the National Defense

Research Committee, to the chairmanship of which Dr. Conant was appointed. The Committee on Uranium became a section of the Office of Scientific Research and Development, and it also was soon designated as the S-1 Section. It remains to note that the Director of the comprehensive Office of Scientific Research and Development (OSRD) was made personally responsible to the Chief Executive and was thus not required to act under the Armed Services.

* * *

In the very immediate wake of the reorganization came major scientific developments from the research center on the Pacific Coast at the University of California. Dr. Seaborg and Dr. Segre measured for the new Element 94 its fission cross-section for fast neutrons by bombarding uranium in a cyclotron. The value they derived, though tentative, was 3.4 times that of natural uranium -- The bearings of that for the labors by Dr. Fermi with the uranium graphite pile were discerned by Coolidge of the National Academy, who sent on a report. That turning point was at the time designated by Bush as "good stuff."

Within that same month of July further noteworthy news was brought back from London by an ordnance specialist who, in a talk with Dr. Bush, outlined a draft-report from Chairman Thomson of the MAUD Technical Committee. The novelty was that the fission did not depend on slow neutrons: that is, with the bulk of the neutrons being fast, chain reactions would develop the more quickly for producing the explosion of tremendous force, - which would be within an energy-range of an upper limit of a million electron-volts. This was another report that gave Bush and Conant what they had been waiting for, as it went way beyond the material by the Briggs Committee and the two National Academy reports.

Another lift to the pitch of pertinence and significance came with the visit to this country of Professor Marcus L. E. Oliphant from Birmingham University. Towards the end of that summer he reported to William D. Coolidge, the author of the second National Academy report, that the British now predicted that the quantity in kilograms of pure U-235 for the operativeness of chain reactions by fast neutrons could be as small as ten kilograms. As Oliphant also visited Berkeley, Ernest Lawrence again became the stimulator and accelerator, by means of a special summary that he induced Oliphant to make of the MAUD Committee report. The occasion for Lawrence's renewed role was the celebration, in mid-September 1941, of the 50th Anniversary of the University of Chicago. The recipient and later communicant of enthusiasm for all these convergent constructive developments was Arthur Compton of the Physics Department of the University of Chicago. A fortnight later came Sir George Thomson, Chairman of the MAUD Committee; and he impressed the Briggs Committee men with the highly optimistic British attitude towards the bomb.

* * *

Upon all this there supervened a major decision by President Roosevelt. Interestingly, it was made within the very week of Sir George Thomson's report, namely that the OSRD was to go ahead with intensive investigations, now that the British recommendations and conclusions were definitively confirmed by the reviewing committees to the future-oriented conviction that U-235 could be separated and made into an effective bomb. Towards the end of the next month, namely on November 27th, Bush's transmittal of a definitive report to Roosevelt was accompanied by a covering letter, stating that he was forming an engineering group and directing the accelerating physics research to the plant-design stage. While that report, in the light of the conferences with President

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Roosevelt, did not by itself require specific approval from the White House, the epochal form for the formality was the return by President Roosevelt of that report to Dr. Bush on January 19, 1942 with the briefest of notes, in his handwriting, for history-shaping eventuations:

"V.B. OK - returned - I think you had best keep this in your safe. FDR"

* * *

Envoi

The immediately ushered-in manifold labors oriented to the future were all dependent on the prospectively-to-be-achieved nuclear chain reaction. As that is covered comprehensively by the firsthand participants in that Fermi achievement at the University of Chicago, the foregoing report on origination is a prelude to that companion-report.

EXHIBITS TO CHAPTER VII

Exhibit 1 to Chapter VII

OCTOBER 11, 1939

THE HONORABLE THE MARQUESS OF LOTHIAN
BRITISH EMBASSY
WASHINGTON, D. C.

IN CONNECTION WITH VISIT AND CONFERENCES AT WASHINGTON WOULD APPRECIATE
OPPORTUNITY CALLING ON YOU DURING EXTENDED WEEK END STOP WILL TELEPHONE
YOUR OFFICE LATE THURSDAY

ALEXANDER SACHS

Exhibit 2 to Chapter VII

BRITISH EMBASSY,
WASHINGTON, D.C.

November 1st, 1939

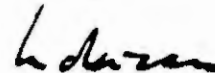
My dear Sachs:

Very many thanks for your kind letter about my Pilgrim speech. I am glad you approved of it and of the Tribune Forum address.

Many thanks also for the papers you attached, which I have read with great interest.

Christie told me how greatly he enjoyed his conversation with you.

Very sincerely yours,



Alexander Sachs, Esq.,
One South William Street,
New York, New York

CONFERENCE WITH LORD LOTHIAN

Neutrality has proved a death trap. Isolationism and defense strategy have run counter to the elementary military lesson that it is best to fight on someone else's soil and to have friends fighting for you.

The American preoccupation with hemispherical defense is a dangerous diversion of attention from the real issue of the protection of the Atlantic gateways. The British Isles, Spain and Portugal are far more important to the U.S. than Bermuda or the West Indies.

Considering the nature of the populations, it is impossible to control the fifth column in North America or South America. By the same token the protection of Ireland from Nazi invasion is more important than any of the countries on this hemisphere. If the British fleet is gone, the U. S. cannot rearm in time.

Hitler gambled his all on the nearly impossible and found it easy of attainment because of the lack of will and understanding in the democracies of their own self-interest. Take the simple question of protecting of outposts. If everybody insists on doing nothing until he is directly invaded, then the abandonment by all of the outposts of each means, as events have proved, that he can amass the maximum of force against each successive situation and so get victory with little cost. Had America entered, Italy would have refrained from joining, and that would have delayed the debacle of France. A France under the control of Germany and Italy means an amenable Spain. The totalitarian powers would thus control all the entries to this Continent and the U. S. would be locked in. Japan could take the Indies and American possessions. We are thus subjected to a double squeeze play in the Pacific and the Atlantic. What is of paramount

importance is that the public recognize that American interests are vitally involved. Once that is recognized, then the right aid and the right measures follow of course. Thus, the British need cruisers and destroyers.

The real issue is how to make effective the combined wealth of the British Empire, the U. S. and the Dutch Empire in order to buy no more than six months' time for the holding out of Britain. America is as vague and unrealistic about the Monroe Doctrine as the British liberal elements have been about collective security in the post-war period. The Liberal Party was all for a program of collective security, but not for armament and defense: It assumed that it would not have to be challenged and that the mere addressing of firm words would be efficacious. Similarly, America has ignored that the Monroe Doctrine has existed by the grace of the British and the British navy. With Britain and the navy gone, the Monroe Doctrine is only an incantation. Such is the Nemesis of sentimentalism.

May 24, 1968

SUBMITTED INSERT IN CHAPTER VII AT PAGE 7 AS NEW SECTION B
REQUIRING PRESENT 'B' TO BE CALLED 'C' WITH ENSUING SECTIONS AT
RESPECTIVE HIGHER LETTERS ALPHABET, AND MATCHING CHANGES IN NUMBERED PAGES

B.

Recapture for First Time Unique Value Bureau of Standards as Investigative
Vehicle for the President, After Armed Forces'
Express Disinterest in Atomic Project

In this distinctive transcribing from the preserved logbooks of the experimental courses that were followed by the intimate advisor to President Roosevelt in the launching of the Atomic Project, our concern in this section is with the definitive negative attitude of the technical heads of the Armed Services - particularly the Navy which alone had a research organization - towards requests as early as the spring of 1939 by the Columbia University Physics Department for support of atomic research on the possibility of technical development. The first proposal to an appropriate governmental military and technical organ was made on the 16th of March 1939 by Professor George B. Pegram, head of the Physics Department of Columbia, to Admiral S. C. Hooper, Director of the Technical Division of Naval Operations, requesting his seeing Professor Fermi with regard to the mere possibility of uranium's liberating multifold "energy per pound as any known explosive".

In that very context the author of the letter recorded his "own feeling that the probabilities are against this" and the great experimenter, Professor Fermi, reenforced that judgment. And as was disclosed fifteen years later by Laura Fermi, at that particular time her husband held and declared - as recalled by him ten years after that visit - that "there was little proof that we were not pursuing a chimera" (Atoms in the Family, 1954, page 162). To near contemporaries, such as that other great collaborator in the Project, Professor Arthur Compton, it appeared two years after Laura Fermi's book that the Navy's disinterest might have been related to (a) "super-caution" by Professor Pegram and (b) the Navy's reaction to it in "not understanding that for an academic scientist even to make such a suggestion meant he considered the matter of urgent importance" (As noted in A.H. Compton's Atomic Quest, 1956, page 26). But if at the time of writing Professor Compton had

at his disposal the exhibit included in the preceding Chapter herein, namely the express turn-down by the technical advisor, Mr. Ross Gunn, to the Naval Research Laboratory on July 10, 1939, he would have realized the Navy's rejection of aid stemmed from the then (a) official policies and (b) also "restriction which was imposed on Government contracts". For these reasons that letter concluded, "I regret this situation but see no escape." The early reply by the Navy to the Pegram-Fermi submission was an expression of thanks for having brought the matter to their attention and an expression of hope that they will be "kept informed regarding further developments".

In fine, contrary to the assumption by that cherished great collaborator in the Atomic Project - embodied in the subsequent publicism and literature - that initial delay did not come from faulty communication. And in point of historic fact/^{it} was followed by numerous interposed obstacles, which required sustained labors by the President and his advisor over the long period from 1939 through 1941. Even if the then or the long persistent attitudes of super-caution had been replaced by the very opposite, - say in the form of a ventured sense of high probability of " nuclear chain reaction" as entertained in early 1940 by the scientific refugees to Britain - the problems of enlistment of support from the Executive with concurrence by the Armed Services would have remained, as documented in detail herein. The original recoil in March 1939 by the appropriate organ of the Armed Services from foistering and from supporting the atomic researchers stemmed from poignant awareness and worry by the Naval and Military authorities about National Defense in the sense they understood it, namely the aggregate of tested weapons, established installations, and sizes of Armed and Naval forces. For that day of the interview with Admiral Hooper, of Naval Research, by Professor Enrico Fermi, as the representative of the small Columbia group of atomic physicists, was the Ides of March 1939 when Hitler had taken total military mastery over Czecho-slovakia as prelude to aggressive demands on Poland and then prelude to war.

Though that sequel to the Munich Settlement in the prior autumn of 1938

had been forecasted by this advisor and re-reviewed in the March 10th Memorandum on "Imminence World War" with a culminative plea for immediate U.S. preparedness, the neutrality-mindedness of the Senate and large parts of the public since the legislation of the mid-Thirties was still so potent that the Senate, under the influence of Senator Borah, resisted and resisted all efforts by President Roosevelt and Secretary Hull to effect at least that revision which would have permitted prospective victims of German aggression, allies of ours from World War I, at least the access to purchase for their own cash in the U. S. the military supplies, which could also have provided mitigation of our then still very large unemployment. Only after the outbreak of war and the Blitz-Conquest of Poland by the Nazis was the President enabled, with a bare majority, to overcome prior resistance by the Senate to his plans for the revision of the Neutrality Act!

But across the thus sketched portentous obstacles which had foreclosed the Armed Services aiding and fostering atomic research, there had been operative that continuity of interchange with the President on the crucial developments between the lectures of Lord Rutherford and F.W. Aston at Cambridge through the post-Munich effectuation of atomic fission as properly interpreted in Scandanavia and conveyed by Niels Bohr to the American physicist. The President and all close aides were throughout the long arduous labors from spring 1939 dedicated not only to revising the Neutrality Act but establishing that National Defense for the U.S., corresponding to the magnitude and speed of the German aggression ahead. In that setting, the fostering and the aiding of atomic research was envisaged by the advisor as inaugurable after the removal of the obstruction to the revision of the Neutrality Act and as capable of release and development in connection ^{with} / continually requisite restoration of economic recovery and full employment through the previously advocated special stimuli from scientific research and applications.

On this orientation the advisor's approach was to utilize that Agency

of the Executive which from the mid-1930's on had been concerned with the role performable by scientific research in promoting economic expansion. The then Director of the National Bureau of Standards, Lyman J. Briggs, who had been appointed in the culminative depression year of 1932, was seeking not only relief from the budget cuts during the depression, but became protagonist from the mid-Thirties of a new career for that Bureau as governmental fosterer of "basic research in physics and chemistry in order to provide the foundations for new industries" (to quote from a later address of his before the American Engineering Council on "The Place of Government in Research", November 11, 1938). This attitude and theme harmonized with this Presidential advisor's critique of the converse theory of a structured American "economic stagnation", as was then propounded and propagated by the Harvard School of Economics under Professor Alvin Hansen. President Karl T. Compton of the Massachusetts Institute of Technology, as then also Chairman of the Science Advisory Board to the Bureau of Standards, was also stressing "the Government's Responsibilities in Science" (in an article in the spring of 1935, Science, Volume 81, April 12, 1935, 350f).

The initial 1935 draft was finally presented to and became the 75th Congress' Bill H.R. 7643 (June 23, 1937). The Bill's aim was thus defined: "To provide for further development of industry and commerce through research in the physical sciences and to promote industry and commerce through business research." According to its terms the Bureau could allot up to half of the funds to be appropriated by Congress to universities and other nonprofit research agencies for specific projects.

The ensuing emergence of competition from other Government Departments and Agencies, along with objections on account of economy by the Bureau of the Budget, delayed action by the Congress even though Science Associations and the Business Advisory Council and also the President, supported that Bill. Towards the culmination of the national economy's expansion phase from mid-1935 to mid-1937 a variety of bills were accorded hearings by the House Committee on Interstate and

Foreign Commerce from late-July that year. But though Mr. Briggs brought endorsements from such prominent men as Arthur Compton, Robert Millikan and Harold Urey, legislation was deferred. After suspension of consideration in the recession phase of the economy the first half of 1938, the opening of the next Congress, the 76th, in the international crisis year of 1939, witnessed reintroduction of the prior Bills with some technical changes.

In mindfulness then of these approaches and efforts by the Bureau of Standards with the support of eminent leaders of American science, this independent counsellor to the President of programs for economic revival and new economic dynamics for the U.S. decided on utilizing the Bureau of Standards as the vehicle for the preliminary investigation with a view to judgment on Governmental fostering of the Atomic Project. Thus the negativism and the adverse actions by the Naval and Military research authorities were more than detoured, and, far from running the risk of challenges from them, individual representatives of both Services, were included as advisors to the technical group of the Bureau of Standards. Through the President and his aide, General Watson, the Director of the Bureau of Standards was led to conduct a series of conferences dominated by the advisor's recommended list of then leading figures in experimental atomic research. Concurrently the Bureau of Standards' promotion of special legislation was allowed to undergo consideration by Congressional Committees during the final stage of American neutrality. The Congressional sponsor of that closing version of the Bureau of Standards Bill, Clarence Lea of California, in his turn asked for the opinion of the then President of the National Academy of Sciences, who responded by drawing attention to questions on patent provisions, though President Karl T. Compton of M.I.T. gave the Bill his endorsement. Dr. Vannevar Bush stressed the shortcomings of the patent provisions.

But that closing year of its consideration in 1941 had already become anachronistic by reason of the establishment as described herein by the Presidential Order of June 1940, following the advisor's recommendation in May, of the National Defense Research Committee. That Committee in official charge of weapons research

had already been working for better than a year on the Atomic Project. Through the stages to be described in the remaining sections of this chapter, the originally devised conferring and deciding organ under the auspices of the National Bureau of Standards had totally eclipsed and obsolesced the Bills that were under consideration by Congressional Committees.

But the superseding of the then Lea Bill by the prospectively tremendous complex of projects, that interlinked pure research and discoveries in atomic physics with applications in technological national defense, brought into much larger and deeper fulfillment than had initially been discerned in the activities of the National Bureau of Standards in the post-Depression decade for the Federal Government's intervention and for the Bureau's effort for instituting and structuring Government's Support of Scientific Research and Scientific Applications for Promoting Industry and Commerce (and Economic Expansion) (as per the declared preamble of the first Bill to the 75th Congress, First Session (H.R.7643), introduced on June 23rd, 1937). Out of the association between the advisor and the President in the surmounting of the obstacles to economic recovery and economic progress came the common orientation for radical departure from and substitution for the then fashionable but unconstructive theory of 'Economic Stagnation' and 'End of the Economic Frontiers' - with limited influence on ^{and} some echoes in that huge project which passed in 1939 called the T.N.E.C. Economic Investigation, as carried out in extended Hearings and Monographs, that were only completed in late-1941. The substitute of the atomic research and the atomic weapon was at first mediated by the Bureau of Standards - ^{against} as/the disinterest in aid by the research organ and leaders of the Armed Services - ^{to it} and that role came naturally/and inherently fitted it by the very reason of its efforts from the early-Thirties into the overlap neutrality years. for innovative proposals to the Congress in behalf of scientific research and development. Thus it served as a framework and a catalyst -

vehicle for the overture phases of continuing and aiding nuclear research and the crystalization of plans for the later eventuated demonstration of so potent a chain reaction as to highly probably predetermining the application into an Atomic Bomb. Coordinately, the scientific and administrative personnel that was repeatedly called in to comment on the successive Bills was later on presented on the enormously larger and more diversified scales of the Atomic Project. Yet, the President through the advisor, who helped overcome and transmute the original obstacle from the foreclosure of the normal military channels, remained dedicated to the basic concept of those Bills, viz. the distinctive and creative role of the Federal Government as a fosterer and distributor of research and development for the then and since corequisite ends of National Defense and at once dynamic and sustained economic prosperity.

Thus, in furtherance of the initial and maintained dual objectives, to wit: National Defense and peace-time productivity of science for National Prosperity, there came before the end of the War - out of a body of thought represented by the exhibits to Chapter II included in this Report - President Roosevelt's letter to Dr. Vannevar Bush, head of the OSRD, with requests for the continuance and the transposition of that monumental experiment to the postwar life and career of the American Nation. The national principle and the national ideal, as formulated at the conclusion of that letter of mid-November 1944, was utilized by Dr. Bush in his reply of July 5th, 1945 sketching forth an at once farsighted and detailed agenda of national tasks. The President's advance request of November 17, 1944 set forth the policy for the continuance of national activities in sustained fulfillment of the dual objectives. And as that was used by Dr. Bush in that reply of July 5th, 1945, as epigraph for his long report on "Science - Endless Frontier", it is at once appropriate and advisable to recapture that policy, formulated at the conclusion of what in the eventual canonical history of the U.S. will have to be accorded the special role

of a Founding Document for our Nation.

" New frontiers of the mind are before us, and if they are
pioneered with the same vision, boldness, and drive with which
we have waged this War, we can create a fuller and more fruitful
employment and a fuller and more fruitful life."

Old Section B of Chapter VII will now become "C" - pages 15 - 16

Old Section C of Chapter VII will now become "D" - pages 16 - 17

Old Section D of Chapter VII will now become "E" - pages 17 thru 19

Old Section E of Chapter VII will now become "F" - pages 19 thru 24

Chron File
12

March 9, 1970

Dear Humberto:

A quartet of eminent physicists and mathematicians - including the co-inventor with the late John Von Neumann of the computer that became the model for the IBM's generation of the Sixties, and including the administrator-physicist who is now in charge of the science research for IBM - met me on Washington's Birthday through a common friend. Their and the Harper editor's interests were checking a book that Warner Heisenberg gave as an Apologia for Germany's failure to have discovered the atomic bomb. As I have not yet read the manuscript my comments were keyed into the unbridgeable dichotomy between retroverted anti-civilization-Nazism and freely interchanging and mutually stimulative thinking by which the human spirit crosses and conquers new frontiers in science and in very great art. As both illustration and demonstration I provided the case of Kapitsa as the one exception who, by being nearly the only one the Soviet tyranny permits to speak, did, in a single utterance of his that was allowed to come out to the Free World, bear witness to that old thesis of mine. That thesis was restated by me in the letter to Dr. Piore (head of the management of science research at IBM) on February 27th, - as per attached extract from that letter.

This quartet of science notables later evinced the keen interest in my rationale for U.S. or more accurately Anglo-Saxon leadership - since if the British had not been under continuing bombardment their atomic physicists, in cooperation with the refugees from Germany, could have accomplished it not only on parity with but in precedence of us. Thus it came about that I supplied some extracts to Dr. Piore, whose role in IBM seems to be scientifically at the top...

Let me now jump, for your sake, to what led me to follow up that long and deep discussion. It was my basic thesis that what enabled Roosevelt and his advisor to overcome the originally presumed unbridgeable opposition of the Naval and Military Chiefs was his conversion to the three interlinked national, economic, and spiritual objectives, namely (1) outflanking the Nazis and averting the terrorizing implications of their prior discovery, (2) gaining world preeminence in a hitherto unexampled governmental fostering of scientific research and applications to economic and social life, and (3) incarnating the dedication of the Founding Fathers of this Republic as heirs of the ideas of the European enlightenment of the union of free government and free society with pursuit of science and human welfare. - All that, as you know, is spelled out in that manuscript after the 25th Anniversary of the Fermi Chain Reaction that I submitted to Professor Anderson, - about whose publication in full text I have not heard.

Beyond this recapture of the true history - corresponding to what the

French call *la vraie verité* - was my desire to test whether so important and so fundamentally appropriate a company as IBM would be interested in the type of Project that I long ago submitted and have kept on stressing in later correspondence to President Levi. Well, the extraordinary has happened. Such a letter has come in to me from Dr. Piore. Therefore, I have felt it appropriate to transmit the material with a covering letter to E.L. A coordinate appropriateness is that the transmittal to him of Dr. Piore's letter of March 3rd, and my own letter to him, should be strictly personal, with copy of the material to be transmitted to you, through E.L. and subject to his approval. That gesture of obeisance does not, however, preclude me from conveying an account of the setting of the now hopefully opened contacts with a great company. So I have thus explained to you the enclosed letter, which until decision by President Levi must remain a confidence between you and me, and thus any transmittal by him is a *de novo* action.

With kind regards to you and your family,

Cordially yours,

Prof. Humberto Fernandez-Moran
5807 Dorchester Avenue
Chicago, Ill. 60637

C. Chinn 174-1

ALEXANDER SACHS
25 BROADWAY
NEW YORK, N. Y. 10004

March 16, 1970
(Primary Letter)

Dear Humberto:

Turning to the request in the telephone conversation with me for re-statement of considerations that you have already featured in your discussion and arrangement with a high official of the University of Chicago Press - regarding early publication of the first volume of submitted material in the context of the University's Fermi Celebration at end-1967 - some additional information and aspects of my originally supplied intimate history of the Atomic Project's origination were contained in my letter of March 9th to President Levi.- Particular attention needs to be drawn to portions of that letter from the top of page two, and at the second line, to mid-page 4. Thus the first long paragraph on page 2 deals with the rejection of the Project by Admiral Hooper.

That harks back to my original inclusion in the manuscript submitted to the University of Chicago, specifically Chapter VI under the heading "Reaction in U.S. from Atomic Fission Experiment Effectuated in Germany at End-1938..." On page 11 of that Chapter there is the recapture of the original encounter with and presentation by Professor Fermi to Admiral Hooper, and Columbia Dean Pegram's effort to get some interest in the Navy of what was regarded as a pure research project without any probability of utility in defense. -

I

At this point it is important to recall that as the very first selected witness by the Chairman and the membership of U.S. Senate Committee On Atomic Energy on November 27, 1945 - in the text of the Government document on "Background and Early History Atomic Bomb Project In Relation to President Roosevelt", pages 553-573 - I recaptured before that Committee and a group of the active atomic physicists, inclusive of Dr. Szilard, the pre-atomic fission history, ^{then} effectuated by Hahn and Strassmann. The prelude to the fission was the remarkable work in Cambridge University under leadership of Lord Rutherford. Accounts of those accomplishments, on which the later planned experiments - designed by Lisa Meitner and executed by Professors Hahn and Strassmann (who as documented by me missed their import until Meitner, Frisch and Neils Bohr interpreted the results as effectuated fission and so conveyed to Hahn) - came earlier within my ken from having attended the lectures of Lord Rutherford and F.W. Aston, as published in autumn 1938 by Cambridge University Press under the title "Background to Modern Science." Reports of the prelude to and supervened effectuated fission were conveyed by me to the President, with the aide of an early copy of the Cambridge book that contained the Rutherford and Aston lectures. My testimony on November 27, 1945 in the then very first disclosure of that history was set forth on page 558 of my reprinted testimony as follows:

"There were these two lectures by the subsequently deceased Lord Rutherford which were revised by an assistant of his, and then there was a separate lecture in addition on Forty Years of Atomic Theory, by F. W. Aston, of Cambridge, who died only a few days ago, as you may have seen the notice. F.W. Aston, reviewing the work that had been done by 1936 and describing what was being done in England and elsewhere, ended up his lecture with a warning and a prophecy. I showed this book to the President with a view to highlighting that, as with other fruits of the tree of knowledge, there is an ambivalence to atomic power with poles of good and evil. The concluding paragraph is as follows:

"There are those about us who say that such research should be stopped by law, alleging that man's destructive powers are already large enough. So, no doubt, the more elderly and ape-like of our prehistoric ancestors objected to the innovation of cooked food and pointed out the grave dangers attending the use of the newly discovered agency, fire. Personally, I think there is no doubt that subatomic energy is available all around us, and that one day man will release and control its almost infinite power. We cannot prevent him from doing so and can only hope that he will not use it exclusively in blowing up his next door neighbor."

As for just quoted pre-fission forecast by F. W. Aston of his conception of the potential explosiveness of "subatomic energy", this sustained advisor to the President since the mid-Thirties of the imminence of Nazi war, followed-up with accounts of developments from the very turn of the year 1938 into 1939, led by the arrival in this country of Dr. Niels Bohr, - the thinker on and promoter of experiments in atomic physics who had facilitated the timely departure of Professor Fermi from Italy to the United States in the prior year.

Though Dr. Bohr at Princeton had indicated in his talk with physicists from Princeton and Columbia University his concern over the dangers to the United States and the Free World from research labors by German scientists on the potential explosiveness of the atomic energy as a weapon, the practical experimental research, then virtually exclusive at Columbia University, ~~which~~ was then under the direction of Professor Pegrum and the new, great European experimenter Professor Fermi, who regarded chain reaction as highly improvable.

The Chapter VI of my manuscript on "Reaction in U.S. from Atomic Fission Experiment Effected in Germany at End-1938..." quotes on page 11 of that Chapter the visit of Professor Fermi with Admiral Hooper and quotes from Mrs. Laura Fermi's 1954 book on "Atoms in the Family" Fermi's confession of recapture of that episode - his postwar explanation of the combined skepticism towards chain reaction in 1939 by both Professor Pegrum and himself. His explanation for the rejection of any aid by the Navy - the only part of the Armed Services which had any money

for research - was as follows:

"You forget that in March 1939 there was little likelihood of an Atomic Bomb, little proof that we were not pursuing a chimera." (University of Chicago Press book, pages 162-4, 1954)

The later definitive refusal by the Navy was contained in the letter of July 10, 1939 by Ross Gunn, Technical Advisor of the Naval Research Laboratory. The account in the history of the Atomic Project by the Atomic Energy Commission in the volume published in 1962 under the title "The New World 1939 - 1946" confirms my account on page 12, though it is not as precise as my report on page 12 of the self same Chapter. The Appendices to that Chapter have as Exhibit No. 1 the precise text of rejection by that technical advisor.

II

Recalling from my testimony before the U.S. Atomic Energy Commission on November 27, 1945, immediately ahead of Professor Fermi's conference with Admiral Hooper in mid-March 1939, this conferrer with the President on the then deemed Nazi preparation for inaugurating the war via the takeover of Czechoslovakia in mid-March, was preceded by this advisor's Memorandum of March 10, 1939. It was summarized as follows in my lead testimony before the U.S. Senate Committee at end-November 1945:

"On March 10, 1939, when I had been asked by St. John's College to deliver a talk on the world situation, I prepared certain notes of which I had sent the President a copy. These were entitled "Notes on Imminence World War in Perspective Accrued Errors and Cultural Crisis of the Inter-War Decades." That memorandum dated March 10, 1939, had this opening sentence:

"This interwar generation has been living on the edge of a smoldering volcano; and the predominant attitudes among both what is called the 'right' and what is called the 'left' have been variants of escapism, very much like peasants situated on the edge of a volcano who go on cultivating the slopes in the hope that the eruptions will not take place in their lifetime...

"The present period is too late for that reversal of error which prevents the consequences of error. That real 'Munich' took place in 1936, in connection with the Rhineland. Then was the last opportunity missed for preventing that cumulative German aggression that was bound to culminate in a new and more terrible war by Germany. But what can and must be done for our salvation and safety is self-clarification and self-reorientation toward the onrushing dangers...

...
"There is still time for western civilization, and especially for the exceptionally and fortunately situated United States, to use the time drafts that can still be made on the 'Bank of History' for the preparedness that has and will become more and more urgent and inevitable for all members of western civilization as a result of the past errors committed and in the course of the prospective unfolding aggressions of Nazi Germany."

As the then conferrer with the President, especially on the European and extra-European aggressive planning by the Nazis, I had been awaiting further appropriate opportunities for eliciting the President's interest in and support of very special measures by the U.S. for anticipatory leadership in atomic research, focussed on the danger of development of atomic energy into an atomic weapon. Considering that the President, throughout summer, had hoped to convert the Senate into revision of the Neutrality Act, it was of the utmost importance for the effectuability of neutrality revision that this subject matter remain protected against any possible leakage. Hence, in the immediate sequel to rejection on July 10, 1939 by the Naval Research Laboratory's advisor Ross Gunn of the plea by Dr. Szilard for some funds for the continuance of the very limited research then proceeding at Columbia University, his request for a meeting to that end with this writer was met on the basis that deliberately excluded the then experimenter on a private basis at Columbia from any transmitted cognisance of what had been proceeding since the beginning of the year, and what would be proceeding later. By then, inquiries of Dean Pegram of the physics department at Columbia advised me of Dr. Szilard's as yet limited relationship to the department, in contrast with Professor Fermi's primary position as the University's chief atomic researcher. Towards the end of the month, precisely on July 26, 1939, I drafted a letter for Dr. Albert Einstein. I had known Dr. Einstein since the Twenties and particularly over the timestretch in the Thirties since the Nazi-inaugurated persecution of scientists. That resultant exodus of a great scientists from Germany, on account of racial prejudice based on the Nuremberg Laws, had been attacked by Dr. Einstein even ahead of full capture of power by Hitler. Dr. Abraham Flexner, the great educator and canalizer of benefactions for science progress in our country, was thus impelled to elicit funds from the Bambergers and others for the establishment of a new institute, concentrated on pure research in science and the humanities, exclusive of the ordinary academic teaching. It became the Institute of Advanced Study at Princeton, and its plans were discussed by him that summer of 1934 when President Frank Aydelotte of Swarthmore College and Secretary of the American Rhoades Scholarship Committee went along with this friend of Lord Lothian as guests for about a week at Lord Lothian's estate in Aylsham, Norfolk. Thus, I had participated in those deliberations for the inauguration of the Institute of Advanced Study and for advices to Dr. Flexner on the then deemed advisable concentration of the new faculty on refugee physicists and other scientists, pivoted on the unanimous agreement on Dr. Albert Einstein as the then champion of liberty of thought and research and

as close friend of Lord Rutherford, who was the head of the British committee for support to scientist refugees from Germany to Britain.

In continuation of the personal historical associations of mine in the then human crisis of expelled scientists from Germany, I prepared a special letter for which I had arranged the securing of Dr. Einstein's signature as part of my dossier for President Roosevelt. But the by then accepted prospects of a war outbreak by Nazi Germany and also Japan as a member of the Axis, required my attendance at my professional labors in the Lehman Corporation as Vice President of it. Therefore, I turned over my draft letter to Dr. Szilard, with permission for some changes. The text of my draft is attached to this page in my original handwriting of July 26, 1939, as reproduced and as later transcribed in typewritten text. It was keyed into human appeal in behalf of the refugee-scientists from Nazi Germany and from Fascist Italy. The opening paragraph of that was as follows:

"It is as one who has come to cherish the freedom quest of the original Pilgrims and shares a similar quest of this decade's new pilgrims from persecution to the 'life and liberty' of this country, that I beg your consideration by this and through our common friend, of an epochal discovery, which bears on U.S. security. At the turn 1938-9 researches, - in which the democracies inclusive scientists-refugees from Nazism and Fascism have led - climaxed in an experiment in Germany which effected the split or fission of the atom, entailing in the process unprecedentedly tremendous energy. Thus has been raised the grave question of possible discovery of ways to harness that power, in that ambivalence for evil as for good ((for)) the fruits of the Tree of Knowledge."

The short concluding paragraph was keyed into knowledge of developments received by many scientists and influential personalities in Europe.

"My more recent followers of these phases of atomic physics in touch with the European developments advise me that Germany has taken over the uranium mines in Czechoslovakia and stopped sales and exports. Arrangements for Canadian and Belgian sources should be made. And as crucial research-issues loom large, governmental and cognate industry and institutes should be interested."

It was through Dr. Aydelotte, who by that time had become the successor of Dr. Flexner as director of the Institute at Princeton, that I conveyed to Dr. Szilard the information of the then vacation place of Dr. Einstein. Dr. Szilard chose to modify that letter in ways that raised questions. Thus, when I was finally given his revised version, I was surprised to find in his draft during his visit with Dr. Einstein on August 2nd the pretentious and unwarranted claim as follows: "And now it appears almost certain that this (nuclear chain reaction) could be achieved in the immediate future." This, of course, was counter to

what had been submitted by Dean Pegrarn and Dr. Fermi to Admiral Hooper regarding their conjointly held view of the improbability of a chain reaction. Moreover, since the mid-March negative conference by Dr. Fermi with Admiral Hooper, there ensued the definitive rejection by the Navy in the above cited letter of July 10, 1939, by the chief technical advisor to the Navy, Ross Gunn. As one without any experience in presentation of proposals to high Government officials, there was a further divergence by Dr. Szilard's revisions from my text, in that he chose to address the President merely as "Sir" and to conclude the letter with "Yours very truly" instead of the accepted term used in my text on the right of the typed reproduction of my letter. Hence, in the later follow-up presentations by me to President Roosevelt my original draft was shown, but in order to avoid any questioning of the differences between the two letters the President was led to accept this advisor's version and to treat the then so premature claim by Dr. Szilard as a case of excess zeal, thus averting conflict between the two chief research men of the Navy and the White House, whose interest I proceeded to be linked up to the major scientific organ of the Government, the Bureau of the Budget.

III

In documented support of the preceding intimate account by this Presidential advisor of the course of events from 1939, and back of it since 1936, I am submitting a series of extracts that the authors of the official history for the U.S. Atomic Energy Commission, under the previously cited title "The New World 1939 - 1946" (by Richard G. Hewlett and Oscar E. Anderson, Jr., published in 1962 by the Pennsylvania State University Press) as the authors' conferences with and examination of documents from this writer:

(1) "Quiet and unpretentious in appearance, Sachs specialized in 'prehistory,' he liked to say. Since 1936, when he had heard Lord Rutherford lecture, the work of the atomic physicists had intrigued him. Then early in February, 1939, while Sachs was visiting in Princeton, Frank Aydelotte, director of the Institute for Advanced Study, showed him a copy of Nature. Sachs's excitement increased as the months went by and further experiments were reported. By the time Szilard called on him in July, he remembered some years later, he had already pointed out to the President the crucial character of the new developments. From Roosevelt, Sachs understood that the Navy had decided not to push uranium research, largely because of the negative attitude of Fermi and Pegrarn. To approach the President successfully, Sachs believed it was necessary to counter the impression created by the Columbia physicists. This would require the testimony of a scientist more eminent than Szilard. The obvious solution was to enlist the name of Einstein..."

(2) "He (Sachs) knew that Roosevelt preoccupied with the international crisis and his fight to win repeal of the arms-embargo from a reluctant Congress, was unlikely to give the uranium recommendations adequate attention....Sachs read

aloud his covering letter, which emphasized the same ideas as the Einstein communication but was more pointed on the needs for funds. As the interview drew to a close, Roosevelt remarked, 'Alex, what you are after is to see that the Nazis don't blow us up.' Then he called in 'Pa' Watson and announced, 'This requires action.'

"This appeal for federal encouragement, if not support, of research touched a theme that went back to the Constitutional Convention of 1787. The powers expressly granted the general government seemed to imply a place for science, but just what this might mean awaited the resolution of constitutional issues that involved science only tangentially..."

(3) "This, then was the situation when Sachs talked with the President. Roosevelt's thinking must have been conditioned by the rather uneasy relations that had existed between the Administration and the scientific community. There was little basis for sentiments of mutual confidence. No adequate machinery was at hand. One alternative was to refer the matter to the National Academy of Sciences, but this was an unwieldy expedient, and there was little reason to believe it would be fruitful..."

"Roosevelt appointed an Advisory Committee on Uranium to investigate the problem in cooperation with Sachs. Its chairman was Lyman J. Briggs, a government scientist who had begun his career in 1896 as a soil physicist in the Department of Agriculture and was now director of the National Bureau of Standards..."

(4) "...On April 5, the President thanked Sachs for forwarding the Einstein letter. He had asked General Watson, he said, to arrange another meeting in Washington at a time convenient for Sachs and Einstein. Roosevelt thought Briggs should attend as well as special representatives from the Army and Navy. This was the most practical method of continuing the research '...I shall always be interested to hear the results,' he said. The same day, Watson sent Briggs a copy of the letter to Sachs and asked for suggestions 'so that this investigation shall go on, as is the wish of the President.'"

(5) "As the outlines of a sensible program emerged, pressure for action intensified. Sachs had no intention of leaving everything to Briggs. He argued the cause in May letters to Roosevelt and Watson..."

IV

*By one of the curious ironies the history of the Atomic Project at recurrent brief intervals for a year from mid-1940 to mid-1941 required sustained labors by this and other Presidential advisors against deflection into the primacy of power instead of a military weapon. As that danger was successfully averted, it is the kind of negative that is vital in historic achievements. But the conventional publicists and historians have alas missed that prevented event, which would have been so dangerous for the U.S. success. More importantly, this rather sustained reflector on and synthesizer of science - in the four-dimensional frame of (1) political, (2) economic, (3) social forces, and (4) science and technology, has consistently maintained that from the very beginning of the conversion of President Roosevelt to the Atomic Project he came to accept that it could prove and should be so conducted as to be succeeded into continuation of what as begun by this advisor was the coordinate integral part of the Project, namely "Scientification of the U.S." Accordingly, several extracts from the official history of the Project for the U.S. Atomic Energy Commission are submitted, bearing on that threatened deflection that came to be prevented.

(1) "In the summer of 1940, American scientists saw it first as a source of power. All of them, certainly, had thought of the possibility of a bomb. Some believed that in achieving a chain reaction they might gain understanding of what it took to make a bomb. But scientists in America did not direct their thinking primarily toward a weapon. When Pegrum and Fermi outlined the research plans for the Columbia team in August, they listed their objectives only as power and large amounts of neutrons for making artificial radioactive substances and for biological and therapeutic applications."

(2) "The year 1941 opened on a note of strident controversy."

(3)-a "Compton's group met with Briggs, Breit, Gunn, Pegrum, Turve, and Urey at the Bureau of Standards on April 30. Briggs reported that the committee on Uranium had been seeking to determine whether fission could be utilized successfully for explosive bombs, radiation bombs, and submarine power..."

(3)-b "But Briggs spent most of the time discussing Columbia work on the chain reaction in normal uranium. Compton came away with the impression that the Committee on Uranium was interested primarily in the generation of power. The National Academy delegation gained no clear understanding of the chances for a bomb. Compton and Breit were not able to get through to each other. A few months later, when an explosive was unquestionably the prime objective, Breit complained that the visiting committeemen exhibited only a polite interest in

a bomb, while Compton declared with equal exasperation that he had been able to obtain only the barest outline of a report on the theoretical investigations into its possibility."

At that vital point near mid-1941 the position of European physicists aided the redirection to the atomic weapon, as reported in the Atomic Energy Commission book as follows:

(4) "...The British, he said, took the uranium work very seriously and believed there was some possibility of developing an explosive within two years. In their efforts to establish a chain reaction, they were giving a great deal of thought to a heavy-water moderator. Halban, whose Cambridge investigations in this area they considered auspicious, was anxious to come to the United States to make closer contact with American research. In isotope separation the leading figure was Franz E. Simon of the Clarendon Laboratory at Oxford. He was hard at work on a gaseous-diffusion system and hoped to have a yes-or-no answer regarding it in July "

By July 1941 the Jewett Committee, formerly of the Bell Laboratories, together with Oliver Buckley of the Bell Laboratories were following that altered trend and working towards the atomic chain reaction and the hoped-for sequel of the Atomic Bomb.

(5) "On July 11, 1941, the reconstituted committee reported that it had reviewed the earlier recommendations from an engineering standpoint and could endorse them...Even more than in May, the chain reaction in natural uranium promised success. A demonstration was needed. This would reveal its potential and call forth such an increase in scientific and engineering effort that practical utilization would follow rapidly...These should start immediately under a project type of organization devoted exclusively to proving the chain reaction and exploiting its possibilities for national defense."

As admitted by the official Atomic Energy Commission history at that stage in early 1941 into April 1941, the British - though lacking resources "in a country fighting for its very life" - had been farther advanced and centrally dedicated to the Atomic Project.

(6) "Briggs submitted his recommendations to the National Defense Research Committee on July 8. The basic objective, he stated, was to ascertain whether a chain reaction was possible. A second was to determine through intermediate piles at Columbia and Chicago and through associated theoretical studies the most promising dimensions, arrangement, and materials to be used in the full-scale experiment on power production. Finally, the aim was to continue work on separating uranium isotopes in quantity. Briggs now urged isotope separation primarily for military purposes..."

The President, on recommendation of his close advisors, adopted the

policy of loosening the contacts with Briggs and centralizing the Project in the newly established Office of Scientific Research and Development, headed by Dr. Bush, as per Executive Order on June 28, 1941.

"The Office of Scientific Research and Development, which Roosevelt established by Executive Order on June 28, 1941, was Bush's effort to remedy these defects at a single stroke. Located within the Office for Emergency Management of the Executive Office of the President, under a director personally responsible to the Chief Executive, the OSRD was to serve as a center for mobilizing the scientific resources of the nation and applying the results of research to national defense. The NDRC would continue, but within the OSRD. Its function was to make recommendations on research and development. The OSRD directorship went to Bush, and Conant replaced him as chairman of the NDRC. The Committee on Uranium became the OSRD Section on Uranium, soon designated cryptically as the S-1 Section."

It is thus that as maintained both by this advisor and the official historians "July 1941 was the turning point in the American Atomic Energy effort."

V.

As the foregoing varied parts of this letter covering the so chequered timespans from October 1939 to July 1941 have provided such detailed information - supported by the official history of the Atomic Energy Commission - in demonstration that years 1940 and the first half of 1941 had recurrently required overcoming shortcomings in the progress of the atomic research and also averting dangers of deflections of the U.S. research into a mere 'Electric Power Project' - paradoxically, the analogue to the basic error in Western Germany after - Hans Strassmann effected - atomic fission - it is most important for recording for the present generation and the future of American history the accumulated distortions that the communications media and mis-called popular histories have imposed on our country. The deemed so urgently required correction for the widely accepted mishistory has arisen because, as explained in the indent covering the whole page 3 of my letter of March 9th to President Levi, even some academic historians when called upon to write about such historical eventuations find it convenient to repeat what might be called 'hallowed errors,'- in order to avoid disputations with the communications media and the press and objection to utilization of other articles on the account of the implicit criticism of the validity of that kind of pretended history:

"The point is thus the basic human and social context in which events occur are not only neglected by that conventional historianation - even by academic historians.- It has ceased to be interested in attending to even approximate truths, let alone what the French call "la vraie verité", or the full truth. With regard to the military and diplomatic events, the large and diverse classes of participants nationally and internationally make up in time replacements for the Hollywoodized journalism of the communications media and the press. But for the so monumental and momentous achievement in human history represented by the then U.S. national economy closer to laissez-faire than any other country, - for that we just have no record."

The above post-mid-1941 functioning of the Project, as targeted on chain reaction, is of course vital for the University of Chicago, since that second half year and the year 1942 were taken up by the Fermi experimenting and successes.

The thus profoundly necessary de-mythologizing of the erroneous personalized single day as the President's decision in favor of being able to launch the Atomic Project on October 11, 1939 is a duty on the University of Chicago, all participants in the Project, and all American history crying for fulfillment.

VI.

Owing to the recurrently threatened detouring of what became the true and so productive new American history, it is necessary to recapture the required overcoming of still other deflections, through this and other advisers to the President, and also aid that was then given them by Professor Marcus L. E. Oliphant, the Australian physicist at the

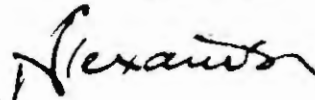
University of Birmingham, who by reason of his work on radar made a summer visit to the United States in mid-1941. Reenforcing Oliphant was other aid by Professor Lawrence at Berkeley, in the course of Oliphant's visit to that institution. Nor was that summer month the final date. For as sequel to the Oliphant visit, Lawrence in September 1941 came to Chicago in celebration at that Institution's 50th Anniversary. The following month, precisely on October 3rd, a most important message was transmitted by George Thomson, the British physicist, Chairman of the MAUD Committee. The then British complete confidence in chain reaction and their focusing on gaseous diffusion reinspired and reconcentrated both our National Academy Committee and the Section on Uranium. Thus ensued a definitive authorization by the President on October 9th. And not until the end of the following month, namely on November 27th, did Bush transmit the definitive report to the President and advise in his covering letter that he was forming an engineering group to accelerate the physics research and to start the plant.

***The officially final definitive date was the return of that report by President Roosevelt on January 19, 1942 (a) with the handwritten words by the President, and (b) with indicated reliance for record preservation on his advisers:*

"V.B. OK - returned - I think you had best keep this in your own safe FDR." ****

With kind regards,

Sincerely yours,



Dr. Humberto Fernandez-Moran
5807 Dorchester Avenue
Chicago, Ill. 60637

***Asterisks denote italics.*

[Atomic?]
Subj

ELECTRO-NUCLEONICS, INC.
368 PASSAIC AVE., P.O. BOX 803
FAIRFIELD, NEW JERSEY, 07006
(201) 227-6700
CABLE: ELECTRONU
TELEX NO: 138302



ELECTRO-NUCLEONICS

NEWS RELEASE

For Release: 12:00 noon, December 6th, 1972
Electro-Nucleonics, Inc., Annual Meeting
St. Regis Hotel, New York, N.Y.

SUBJECT: Proposal by Electro-Nucleonics to the U. S. Atomic
Energy Commission on its Role in the Development of
Private Uranium Enrichment Capacity

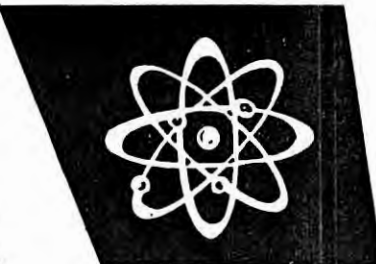
Electro-Nucleonics, Inc., Fairfield, N. J., announced at its annual meeting in New York today that it has responded to a request for proposals by the Atomic Energy Commission under its progressive program to encourage private participation in the uranium enrichment process.

In the proposal Electro-Nucleonics indicated it has formed an investigating engineering, development and management team, consisting of Burns & Roe, Inc., Oradell, N. J., Martin Marietta Corp., Baltimore, Md., Hercules, Inc., Wilmington, Del., and W. R. Grace Company, New York, N. Y. Electro-Nucleonics proposes to be involved in the development and fabrication of gas centrifuges for use in producing enriched uranium as fuel material for nuclear power plants.

Enriched uranium is the principal fuel material used in the present generation of light water cooled and moderated nuclear power plants. Both government and nuclear power industry experts predict shortages of enriched uranium by 1981. It is the intent of Electro-Nucleonics to provide gas centrifuges, related components, and potentially, uranium enrichment plants and services during the 1970's in order to meet the expanding nuclear fuel requirements of the electric utilities during the next decades.

Electro-Nucleonics has been involved in private research and development of the gas centrifuge process for uranium enrichment from 1960 to 1967. Since 1967 the company has been a prime contractor to the Atomic Energy Commission in gas centrifuge component development.

[Atomic?]
Subj.



**UNITED STATES
ATOMIC ENERGY COMMISSION**
WASHINGTON, D.C. 20545

No. R-12
Contact: Philip D. Keif
Tel. 301/973-3335

FOR IMMEDIATE RELEASE
(Monday, January 8, 1973)

**AEC ACCEPTS SEVEN PROPOSALS
FOR URANIUM ENRICHMENT R&D**

The Atomic Energy Commission has accepted the seven proposals submitted for access to the Government's technology for the purpose of conducting privately sponsored research and development on uranium enrichment technology.

The seven proposals were submitted under Step II of the AEC's Domestic Access Program which would provide access to the AEC-developed gaseous diffusion or gas centrifuge technology.

Six of the seven proposals primarily involve the gas centrifuge field while the other, by Reynolds Metals Company, concerns aspects of the gaseous diffusion method. The other six proposals were submitted by Electro-Nucleonics, Inc.; General Electric Company; Goodyear Tire & Rubber Company; Jersey Nuclear Company; United Aircraft Corporation, and Westinghouse Electric Corporation.

The Domestic Access Program was initiated in June 1971 for the purpose of permitting privately sponsored research and development on uranium enrichment. Twenty-one companies were granted access to determine their interest in preparing a proposal and 17 of the 21 said they intended to submit proposals. Seven of the 17 submitted proposals before the November 30, 1972, deadline.

As a supplement to the Domestic Access Program, the Commission announced on December 8, 1972, that it was proposing new regulations which would provide access to Government technology for use in the design, construction and operation of facilities to provide enriching services or to manufacture enriching components.

AEC Chairman James R. Schlesinger told the Congressional Joint Committee on Atomic Energy last March;

(Over)

"The Commission believes that it is now timely to give our full encouragement to the private sector to proceed to develop plans and proposals to engage in providing commercial uranium enriching plants to be needed in the early 1980s, and beyond."

Uranium enrichment is currently performed in three AEC-owned gaseous diffusion plants in Tennessee, Kentucky and Ohio and is the only part of the civilian U. S. nuclear power industry not yet in private hands.

Uranium enrichment involves the separation of the fissionable isotope U-235 (which makes up only seven-tenths of one percent of natural uranium) from U-238. The future market for enriched uranium is primarily as a fuel in nuclear power plants for the production of electricity. The projected growth of nuclear power plants, foreign and domestic, is so great that new enriching plants involving investments of several billions of dollars will be needed to be in operation by the mid-1980s.

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[Atomic?]
Subj.



ELECTRO-NUCLEONICS

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REPORT TO SHAREHOLDERS

January 15, 1973

SUBJECT: Atomic Energy Commission Accepts Electro-Nucleonics'
Proposal for Uranium Enrichment R & D

The Electro-Nucleonics proposal to the Atomic Energy Commission concerning its participation in the Step II program of uranium enrichment utilizing the gas centrifuge process has been accepted. Your company will now commence active work in this program.

The full text of the Atomic Energy Commission's announcement is enclosed for your information.

As the enclosed News Release, made public at our Annual Meeting last month indicates, Electro-Nucleonics has formed a team of companies to explore involvement in the development and fabrication of gas centrifuges and related equipment.

Arrangements for occupancy of a research, development and gas centrifuge production facility of adequate size and scope for this program, have already been initiated by your company.

Vincent V. Asajian
Chairman

metals for nuclear energy

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SECTION TWO OF AMERICAN METAL MARKET - WEDNESDAY, JUNE 20, 1973

AMERICAN METAL MARKET
June 21, 1973

Chemtree Says: 'Metallic Mortars For Safety and Economy'

By W.M. CORNELIUS HALL
CENTRAL VALLEY, N.Y. —
Metallic mortars have in late 1972 and early 1973 achieved a long-delayed acceptance for bulk shielding of nuclear power reactors. Increased safety by their use has been the compelling reason for this acceptance. Superior attenuation of nuclear radiations and superior structural properties has made concrete take a back seat for primary shield construction of many projects under way.

Lower radiation exposure for plant personnel and significant cost savings may both be effected for boiling water reactors with a thinner than standard primary shield. The two shields, with the calculated costs, are shown in the table on this page.

REMs per hour through the new shield are reduced by nearly an order of magnitude. The biological

ing water reactor at temperatures as high as 600 deg. F for one week, although the worst design basis accident may hold the sacrificial shield to similar temperatures for a significant fraction (more than one-tenth) or a day. We conclude that this iron mortar will endure any conceivable accident in a boiling water plant and provides an extra margin of safety to the plant workers, in that concrete so exposed would most likely be weakened and damaged in the same period."

Tensile strength is for many nuclear radiation shielding applications, a property of larger significance than the compressive strength. Chemtree 1-20-26 has a nearly 50 percent higher tensile strength than does concrete. This is a deciding factor in its favor for many applications.

The compressive strength of

primary shield of Chemtree 1-20-26 will correct this situation.

Recent studies of several pressure water reactors of different manufacturers show that much the same situation exists for them. These usually have had five feet of concrete. As Chemtree 1-20-26 reduces radiation through each 13 inch thickness by about one-half that through an equal thickness of concrete. The reduction through five feet is calculated as follows: For 26 inches it is 1/2 x 1/2 - 1/4, for 39 inches it is 1/2 x 1/2 x 1/2 - 1/8, for 52 inches it is 1/2 x 1/2 x 1/2 - 1/16. It would be 1/32 for 65 inches, but for 5 feet it is 1/25. Thus, 5 feet of concrete lets about 25 times as much radiation through as does the same thickness of Chemtree 1-20-26.

"Nuclear Power Reactor Safety" was recently published by the

STANDARD SHIELD			
Layer No.	Material	Thickness	Cost
1	Steel	0.25-inch	\$ 26,000.00
2	Ordinary concrete	25.75-inch	57,200.00
3	Steel	1.75-inch	216,300.00
Totals		27.75-inch	\$299,500.00
NEW SHIELD			
Layer No.	Material	Thickness	Cost
1	Steel	0.25-inch	\$ 26,000.00
2	Chemtree 1-20-26	25.75-inch	112,000.00
3	Steel	0.25-inch	26,000.00
Totals		26.25-inch	\$164,000.00

radiation dose of a plant worker in a full day of exposure is reduced with the new shield to what it was formerly one hour with the old shield. The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, which was published and sponsored by the Environmental Protection Agency and the Department of Health Education & Welfare in December 1972, creates enormous pressure for lowering of radiation levels for plant workers. Prepared by the National Academy of Sciences, this report accepts ionizing radiations as an exponential hazard. As a consequence the electric power companies, who are the owner-operators of nuclear power reactors, now insist on minimal nuclear radiation exposure for not only the public, as in the past, but now also for their own people.

Chemtree 1-20-26 has a significant "Time and Temperature Safety Factor" over concrete. Dr. H.E. Hungerford, of the Nuclear Engineering Department of Purdue University and a consultant to Chemtree Corp., in his paper "Studies on Engineering and Economic Aspects of a New Iron Mortar Material for Reactor Shielding," which was published in the December 1972 issue of "Nuclear Engineering and Design".

(North Holland Publishing Company, Amsterdam, Holland) reports as follows:

"Heating tests were conducted to determine the behavior of the iron mortar and simulated accident conditions in a nuclear power plant. There is presently postulated no conceivable accident that would hold the sacrificial shield of a boil-

Chemtree 1-20-26 is about 20 percent higher than regular concrete, it is equal or slightly better than that usually specified for boiling water reactors and for pressure water reactors. It is less than that needed for high temperature gas cooled reactors, but its' sister product Chemtree 1-20-26X fully satisfies this need.

The superior attenuating efficiency of Chemtree 1-20-26 over concrete is that it has nearly twice the hydrogen content and one and one half times the density. The higher hydrogen content makes it superior for neutron attenuation and the higher density makes it superior for gamma attenuation.

The radiations from the reactor core which strike the primary shield are both neutrons and gamma rays. Neutrons are particles of matter. When uranium 235 fissions in the reactor core, two atoms are created of elements of lesser mass and some neutrons are left over. Some of these neutrons fission other uranium atoms, some neutrons interact with other core components creating gamma rays and other neutrons move outwards. The neutrons and gamma rays moving out strike the primary shield, some are scattered back, but most penetrate the shield. The primary shield is usually designed so that few neutrons will pass through its outer face. Prior custom has depended heavily on the secondary shield to lower the gamma radiation to near that of normal background. Penetration of the secondary shield has thus exposed plant personnel to undesirable radiation levels. The improved

Southern Interstate Nuclear Board of Atlanta, Georgia. This is a tutorial book covering all aspects of nuclear power reactor safety. SINE published it to help administrative personnel of the Southern State Governments and of the Electric Utilities in the south to understand nuclear power reactors, their problems, and how the problems are best handled. A monograph on shielding reactors by Dr. H.E. Hungerford and this author is featured therein. This is the first book to explain the properties and advantages of metallic mortars. It is available for public purchase.

Metallic mortars have been and are being designed into reactors not only in the USA but around the world. Relatively near term procurement is anticipated for reactors in Italy and Taiwan. A reactor in Spain has already done so.

Each of these involves special situation materials of higher price than the bulk shielding material Chemtree 1-20-26. Serious consideration is being given in France, Germany, Sweden and Switzerland for bulk primary shields of Chemtree 1-20-26 or Chemtree 1-20-26. Metallic mortars may become a small but favorable factor in the USA balance of payment.

Mr. Hall is president and chief scientist of Chemtree Corp., Central Valley, N.Y.