To: Secretary of War - Attention: Mr. George Harriman
From: Arthur H. Compton

In re: Memorandum on "Political and Social Problems" from Members of the "Metallurgical Laboratory" of the University of Chicago.

Dear Mr. Secretary:

I have submitted to you a memorandum which has been prepared on short notice by certain key members of the scientific staff of the Metallurgical Laboratory of the University of Chicago. It deals with the long-term consequences of use of the new weapons with which we are concerned. I am submitting this at the request of the Laboratory, for the attention of your Interim Advisory Committee. The memorandum has not yet been considered by other members of the "Scientific Panel." This will be done within a few days, and a report by the panel dealing with the matter in question will be submitted. In the meantime, however, because time is short for making the necessary decisions, I have personally taken the liberty of transmitting this memorandum to you for the consideration of your committee.

The main point of this memorandum is the predominating importance of considering the use of nuclear bombs as a problem of long-range policy rather than for its military advantage in this war. Their use should thus be directed primarily toward bringing about some international control of the means of nuclear warfare.

The proposal is to make a technical but not military demonstration, preparing the way for a recommendation by the United States that the military use of atomic explosives be outlawed by an international agreement. It is contended that its military use by us now will prejudice the world against accepting any future recommendation by us that its use be not permitted.

I note that two important considerations have not been mentioned:

(1) that failure to make a military demonstration of the new bombs may make the war longer and more expensive of human lives, and

(2) that without a military demonstration it may be impossible to impress the world with the need for national sacrifices in order to gain lasting security.

June 12, 1945
To: Secretary of War – Page 2

Nevertheless, the importance of the problem considered, and the weight of the arguments presented for never permitting the bombs to be used in war, are such that I have considered it wise to bring the memorandum immediately to your attention.

Yours very truly,

Arthur H. Compton

Arthur H. Compton
Political and Social Problems

I. Problem p. 2

II. Perspectives of Armament Race p. 3

III. Perspectives of Agreement p. 7

IV. Methods of International Control p. 12

Summary p. 16

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I. Preface

The only reason to treat nuclear power differently from all the other developments in the field of physics is its staggering possibilities as a means of political pressure in peace and sudden destruction in war. All present plans for the organization of research, scientific and industrial development, and publication in the field of nucleonics are conditioned by the political and military climate in which these plans are to be carried out. Therefore, in making suggestions for the postwar organization of nucleonics, a discussion of political problems cannot be avoided. The scientists on this Project do not presume to speak authoritatively on problems of national and international policy. However, we found ourselves, by the force of events, in the position of a small group of citizens cognizant of a grave danger for the safety of this country as well as for the future of all the other nations, of which the rest of mankind is unaware. We therefore felt it our duty to urge that the political problems arising from the mastering of nuclear power, be recognized in all their gravity, and that appropriate steps be taken for their study and the preparation of necessary decisions. We hope that the creation of the Committee by the Secretary of War to deal with all aspects of nucleonics, indicates that these implications have been recognized by the government. We feel that our acquaintance with the scientific elements of the situation and prolonged preoccupation with its world-wide political implications, imposes on us the obligation to offer to the Committee some suggestions as to the possible solution of these grave problems.

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Scientists have often been accused of providing new weapons for the mutual destruction of nations, instead of improving their well-being. It is undoubtedly true that the discovery of flying, for example, has so far brought much more misery than enjoyment and profit to humanity. However, in
the past, scientists could disclaim direct responsibility for the use to which
mankind had put their disinterested discoveries. To cannot take the same
attitude now because the success which we have achieved in the development of
nuclear power is fraught with infinitely greater dangers than were all the in-
vitations of the past. All of us, familiar with the present state of nucleonics,
live with the vision before our eyes of sudden destruction visited on our
own country, of Pearl Harbor disaster, repeated in thousandfold magnification,
in every one of our major cities.

In the past, science has often been able to provide adequate protection
against new weapons it has given into the hands of an aggressor, but it cannot
promise such efficient protection against the destructive use of nuclear power.
This protection can come only from the political organization of the world.
Among all arguments calling for an efficient international organization for
peace, the existence of nuclear weapons is the most compelling one. In the
absence of an international authority which would make all resort to force in
international conflicts impossible, nations could still be diverted from a
path which must lead to total mutual destruction, by a specific international
agreement barring a nuclear armaments race.

II. Prospects of Armaments Race

It could be suggested that the danger of destruction by nuclear weapons
can be prevented - at least as far as this country is concerned - by keeping
our discoveries secret for an indefinite time, or by developing our nucleonic
arms at such a pace that no other nations would think of attacking us
from fear of overwhelming retaliation.

The answer to the first suggestion is that although we undoubtedly are
at present ahead of the rest of the world in this field, the fundamental facts
of nuclear power are a subject of common knowledge. British scientists know
as much as we do about the basic wartime progress of nucleonics - with the
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exception of specific processes used in our engineering developments — and the

background of French nuclear physicists plus their occasional contact with our

projects, will enable them to catch up rapidly, at least so far as basic scient-

ific facts are concerned. German scientists, in whose discoveries the whole
development of this field has originated, apparently did not develop it during
the war to the same extent to which this has been done in America; but to the
last day of the European war, to have been living in constant apprehension as
to their possible achievements. (The knowledge that German scientists were
working on this weapon and that their government certainly had no scruples
against using it when available, was the main motivation of the initiative

which American scientists have taken in developing nuclear power on such a
large scale for military use in this country.) In Russia, too, the basic facts
and implications of nuclear power were well understood in 1940, and the exper-

iences of Russian scientists in nuclear research is entirely sufficient to

enable them to retrace our steps within a few years, even if we would make

all attempts to conceal them. Furthermore, we should not expect too much

success from attempts to keep basic information secret in peacetime, when

scientists acquainted with the work on this and associated Projects will be

scattered to many colleges and research institutions and many of them will

continue to work on problems closely related to those on which our develop-
ments are based. In other words, even if we can retain exclusively in basic

knowledge of nuclearics for a certain time by maintaining the secrecy of all
results achieved on this and associated Projects, it would be foolish to hope
that this can protect us for more than a few years.

It may be asked whether we cannot achieve a monopoly on the raw materials

of nuclear power. The answer is that even though the largest know deposits

do uranium ores are under the control of powers which belong to the "western"
group (Canada, Belgium and British Indies); the old deposits in Czechoslovakia

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are outside this sphere. Russia is known to be mining radium on its own territory; and even if we do not know the size of the deposits discovered so far in the USSR, the probability that no large reserves of uranium will be found in a country which covers 1/2 of the land area of the earth (and whose sphere of influence takes in additional territory), is too small to serve as a basis for security. Thus, we cannot hope to avoid a nuclear armament race, either by keeping secret from the competing nations the basic scientific facts of nuclear power, or bycornering the raw materials required for such a race.

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One could further ask whether we cannot feel ourselves safe in a race of nuclear armaments by virtue of our greater industrial potential, including greater diffusion of scientific and technical knowledge, greater volume and efficiency of our skilled labor corps, and greater experience of our manage- ment—all the factors whose importance has been so strikingly demonstrated in the conversion of this country into an arsenal of the Allied Nations in the present war. The answer is that all that these advantages can give us, is the accumulation of a larger number of bigger and better atomic bombs— and this only if we produce these bombs at the maximum of our capacity in peace time, and do not rely on conversion of a peace time nucelomics industry to military production after the beginning of hostilities.

However, such a quantitative advantage in reserves of bottled destructive power will not make us safe from sudden attack. Just because a potential enemy will be afraid of being "outnumbered and outgunned", the temptation for him may be overwhelming to attempt a sudden unprovoked blow—particularly if he would suspect us of harboring aggressive intentions against his security or "sphere of influence." In no other type of warfare does the advantage lie so heavily with the aggressor. He can place his "infernal machines" in advance in all our major cities and explode them simultaneously, thus destroying a
a major part of our industry and killing a large proportion of our population, 
aggregated in densely populated metropolitan districts. Our possibilities of 
retaliation - even if retaliation would be considered compensation for the 
loss of tens of millions of lives and destruction of our largest cities - will 
be greatly handicapped because we must rely on aerial transportation of the 
atomic bombs, particularly if we would have to deal with an enemy whose industry and 
population are dispersed over a large territory.

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In fact, if the race of nuclear armaments is allowed to develop, the 
only apparent way in which our country could be protected from the paralyzing 
effects of a sudden attack is by dispersal of industries which are essential 
for our war effort and dispersal of the population of our major metropolitan 
cities. As long as nuclear bombs remain scarce (this will be the case until 
uranium and thorium cease to be the only basic materials for their fabrication) 
efficient dispersal of our industry and the scattering of our metropolitan 
population will considerably decrease the temptation of attacking us by 
nuclear weapons.

Ten years hence, an atomic bomb containing perhaps 20 kg of active material, 
may be detonated at 65% efficiency, and thus have an effect equal to that of 
20,000 tons of TNT. One of these may be used to destroy something like 3 
square miles of an urban area. Atomic bombs containing a larger quantity 
of active material but still weighing less than one ton may be expected to 
be obtainable within ten years which would destroy over ten square miles 
of a city. A nation which is able to assign 10 tons of atomic explosives for 
the preparation of a sneak attack on this country, can then hope to achieve 
the destruction of all industry and most of the population in an area from 
600 square miles upwards. If no choice of targets, in any area of five hun-
dred square miles of American territory, will contain a large enough fraction 
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of the nation's industry and population to make their destruction a crippling
blow to the nation's war potential and its ability to defend itself, then the
attack will not pay, and will probably not be undertaken. At present, one
would easily select in this country a hundred blocks of five square miles each
where simultaneous destruction would be a staggering blow to the nation.
(A possible total destruction of all the nation's naval forces would be only
a small detail of such a catastrophe.) Since the area of the United States
is about six million square miles, it should be possible to scatter its indus-
trial and human resources in such a way as to leave no 500 square mile im-
portant enough to serve as a target for nuclear attack.

We are fully aware of the staggering difficulties of such a radical change
in the social and economic structure of our nation. We felt, however, that
the dilemma had to be stated, to show that kind of alternative methods of
protection will have to be considered if no successful international agreement
is reached. It must be pointed out that in this field we are in a less favor-
able position than nations which are either more densely populated and
those industries are more scattered, or whose governments have unlimited pow-
er over the movement of population and the location of industrial plants.

If no efficient international agreement is achieved, the race of nuclear
arms will be on in earnest not later than the morning after our first
demonstration of the existence of nuclear weapons. After this, it might take
other nations three or four years to overcome our present headstart, and 8 or
10 years to draw even with us if we continue to do intensive work in this
field. This might be all the time we have to bring about the re-grouping
of our population and industry. Obviously, no time should be lost in inaugu-
rating a study of this problem by experts.

III. Perspectives of Agreement

The prospect of nuclear warfare and the type of measures which have to
be taken dramatically change the situation. It is clear that the develop-
ment of nuclear weapons and the techniques of their use will have a
staggering impact on future international relations. The need for an interna-
tional agreement to control the spread of nuclear weapons and to promote
peace is urgent. The United States must take a leading role in this effort.

This is a very difficult task, and it will require the active participation of
all nations. It is essential that we work together to achieve a comprehensive
agreement that will ensure the non-proliferation of nuclear weapons. This
agreement should include strict controls on the production, use, and transfer
of nuclear technology. It is critical that we establish a strong international
framework for the peaceful use of nuclear energy.

In conclusion, the United States must take a strong and active role in the
struggle to prevent the spread of nuclear weapons and to promote interna-
tional cooperation. Only through such efforts can we hope to achieve a
world free of nuclear weapons and a future of peace and prosperity.
be taken to protect a country from total destruction by nuclear bombing, must be as abhorrent to other nations as to the United States, England, France, and the smaller nations of the European continent, with their congeries of people and industries, are in an entirely hopeless situation in the face of such a threat. Russia, and China are the only great nations which could survive a nuclear attack. However, even though these countries value human life less than the peoples of Western Europe and America, and even though Russia, in particular, has an immense space over which its vital industries could be dispersed and a government which can order this dispersion, the day it is convinced that such a measure is necessary - there is no doubt that Russia, too, will shudder at the possibility of a sudden disintegration of Moscow and Leningrad, almost miraculously preserved in the present war, and of its now industrial cities in the Urals and Siberia. Therefore, only lack of mutual trust, and not lack of desire for agreement, can stand in the path of an efficient agreement for the prevention of nuclear warfare. The achievement of such an agreement will thus essentially depend on the integrity of intentions and readiness to sacrifice the necessary fraction of one's own sovereignty, by all the parties to the agreement.

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From this point of view, the way in which the nuclear weapons, not secretly developed in this country, will first be revealed to the world appears of great, perhaps fateful importance.

One possible way - which may particularly appeal to those who consider the nuclear bombs primarily as a secret weapon developed to help win the present war - is to use it without warning on an appropriately selected object in Japan. It is doubtful whether the first available bombs, of comparatively low efficiency and small size, will be sufficient to break the will or ability of Japan to resist, especially given the fact that the major
As attacks like Tokyo, Nagoya, Osaka, and Kobe already will largely be reduced to ashes by the slower process of ordinary aerial bombing, certain and perhaps important tactical results undoubtedly can be achieved, but we nevertheless think that the question of the use of the very first available atomic bombs in the Japanese war should be weighed very carefully, not only by military authority, but by the highest political leadership of this country. If we consider international agreement on total prevention of nuclear warfare as the paramount objective, and believe that it can be achieved, this kind of introduction of atomic weapons to the world may easily destroy all our chances of success. Russia, and even allied countries which bear least mistrust of our words and intentions, as well as neutral countries, will be deeply shocked.

It will be very difficult to persuade the world that a nation which was capable of secretly preparing and suddenly releasing a weapon as indiscriminate as the rocket bomb and a thousand times more destructive, is to be trusted in its proclaimed desire of having such weapons abolished by international agreement. We have large accumulations of poison gas, but do not use them, and recent polls have shown that public opinion in this country would disapprove of such a use even if it would accelerate the ending of the Far Eastern war. It is true, that some irrational element in mass psychology makes gas poisoning more revolting than blasting by explosives, even though gas warfare is in no way more "inhuman" than the war of bombs and bullets. Nevertheless, it is not at all certain that the American public opinion, if it could be enlightened as to the effect of atomic explosives, would support the first introduction by our own country of such an indiscriminate method of wholesale destruction of civilian life.

Thus, from the "optimistic" point of view - looking forward to an international agreement on prevention of nuclear warfare - the military advantages and the saving of American lives, achieved by the sudden use of atomic bombs against Japan, may be outweighed by the ensuing loss of confidence and war
of horror and requisition, sweeping over the rest of the world, and perhaps
spreading over the public opinion at home.

From this point of view a demonstration of the new weapon may best be
made before the eyes of representatives of all United Nations, on the desert
or a barren island. The best possible atmosphere for the achievement of an
international agreement could be achieved if America would be able to say to
the world, "You see what weapon we had but did not use. We are ready to
renounce its use in the future and to join other nations in working out
adequate supervision of the use of this nuclear weapon."

This may sound fantastic, but then in nuclear weapons we have something
entirely new in the order of magnitude of destructive power, and if we want
to capitalize fully on the advantage which its possession gives us, we must
use new and imaginative methods. After such a demonstration the weapon could
be used against Japan if a sanction of the United Nations (and of the public
opinion at home) could be obtained, perhaps after a preliminary ultimatum
to Japan to surrender or at least to evacuate a certain region as an alternative
to the total destruction of this target.

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It must be stressed that if one takes a pessimistic point of view and dis-
counts the possibilities of an effective international control of nuclear
weapons, then the advisability of an early use of nuclear bombs against Japan
becomes even more doubtful - quite independently of any humanitarian consid-
erations. If no international agreement is concluded immediately after the
first demonstration, this will mean a flying start of an unlimited armaments
race. If this race is inevitable, we have all reason to delay its beginning
as long as possible in order to increase our headstart still further. It
took us three years, roughly, under forced draft of wartime urgency, to
complete the first stage of production of nuclear explosives - that based on
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the separation of the rare fissionable isotope

the production of an equivalent quantity of another fissionable element. This
stage required large-scale, expensive constructions and laborious procedures.
We are now on the threshold of the second stage - that of converting into
fissionable material the comparatively abundant common isotopes of thorium
and uranium. This stage requires no elaborate plans and can provide us in
about 6 - 8 years with a really substantial stockpile of atomic bombs. Thus
it is to our interest to delay the beginning of the armaments race at least
until the successful termination of this second stage. The benefit to the
nation, and the saving of American lives in the future, achieved by renouncing
an early demonstration of nuclear bombs and letting the other nations come into
the race only reluctantly, on the basis of guesswork and without definite
knowledge that the "thing does work," may far outweigh the advantages to be
acquired by the immediate use of the first and comparatively inefficient bombs
in the war against Japan. At the least, pros and cons of this use must be
carefully weighed by the supreme political and military leadership of the
considerations, merely of
country, and the decision should not be left to military tactics.

One may point out that scientists themselves have initiated the develop-
ment of this "secret weapon" and it is therefore strange that they should be
reluctant to try it out on the enemy as soon as it is available. The answer
to this question was given above - the compelling reason for creating this
weapon with such speed was our fear that Germany had the technical skill
necessary to develop such a weapon without any moral restraints regarding its
use.

Another argument which could be quoted in favor of using atomic bombs as
soon as they are available is that so much taxpayers' money has been invested
in these Projects that the Congress and the American public will require a
return for their money. The above-mentioned attitude of the American public

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the separation of the rare fissionable isotope $^{235}U$, or its utilization for the production of an equivalent quantity of another fissionable element. This stage required large-scale, expensive constructions and laborious procedures. We are now on the threshold of the second stage - that of converting into fissionable material the comparatively abundant common isotopes of thorium and uranium. This stage requires no elaborate plans and can provide us in about 5 - 6 years with a really substantial stockpile of atomic bombs. Thus it is to our interest to delay the beginning of the armaments race at least until the successful termination of this second stage. The benefit to the nation, and the saving of American lives in the future, achieved by renouncing any early-demolition of nuclear bombs and letting the other nations come into the race only reluctantly, on the basis of guesswork and without definite knowledge that the "thing does work," may far outweigh the advantages to be gained by the immediate use of the first and comparatively inefficient bombs in the war against Japan. At the least, some one of this use must be carefully weighed by the supreme political and military leadership of the country, and the decision should not be left to military tactics and calculations alone.

One may point out that scientists themselves have initiated the development of this "secret weapon" and it is therefore strange that they should be reluctant to try it out on the enemy as soon as it is available. The answer to this question was given above - the compelling reason for creating this weapon with such speed was our fear that Germany had the technical skill necessary to develop such a weapon without any moral restraints regarding its use.

Another argument which could be quoted in favor of using atomic bombs as soon as they are available is that so much taxpayers' money has been invested in these projects that the Congress and the American public will require a return for their money. The above-mentioned attitude of the American public led to the creation of the first atomic bomb, and it is therefore strange that the public should be reluctant to use it against Japan.
opinion in the question of the use of poison gas against Japan shows that one
can expect it to understand that a weapon can sometimes be made ready only
for use in extreme emergency; and as soon as the potentialities of nuclear
weapons will be revealed to the ‘normal people, one can be certain that it
will support all attempts to make the use of such weapons impossible.

Once this is achieved, the large installations and the accumulation of
explosive materials at present earmarked for potential military use, will
become available for important peace-time developments, including power
production, large engineering undertakings, and mass production of radioactive
materials. In this way, the money spent on war time development of nuclearics
may become a boon for the peace time development of national economy.

IV. Methods of International Control

We now consider the question of how an effective international control of
nuclear armaments can be achieved. This is a difficult problem, but we think
it to be soluble. It requires study by statesmen and international lawyers,
and we can offer only some preliminary suggestions for such a study.

Given mutual trust and willingness on all sides, the certain part
of their guardian rights, by allowing international control of certain
phases of national economy, the control could be exercised (alternatively or
simultaneously) on two different levels.

The first and perhaps simplest way is to ration the raw materials
-primarily, the uranium ores. Production of nuclear explosives begins with
processing of large quantities of uranium in large isotope separation plants
or huge production piles. The amounts of ore taken out of the ground at
different locations could be controlled by resident agents of the international
Control Board, and each nation could be allotted only an amount which would

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make large scale separation of fissionable isotopes impossible.

One large scale separation of fissionable isotopes is impossible. Such a limitation would have the drawback of making impossible also the development of nuclear power production for peace-time purposes. However, it does not need to prevent the production of radioactive elements on a scale which will revolutionize the industrial, scientific and technical use of these materials, and will thus not eliminate the main benefits which nuclearics promises to bring to mankind.

An agreement on a higher level, involving more mutual trust and understanding, would be to allow unlimited production, but keep exact bookkeeping on the fate of each pound of uranium mined. Certain difficulty with this method of control will arise in the second stage of production, when one pound of pure fissionable isotope will be used again and again to produce additional fissionable material from thorium. These could perhaps be overcome by extending control to the mining and use of thorium, even though the commercial use of this metal may cause complications.

If check is kept on the conversion of uranium and thorium ore into pure fissionable materials, the question arises how to prevent accumulation of large quantities of such materials in the hands of one or several nations. Accumulations of this kind could be rapidly converted into atomic bombs if a nation would break away from international control. It has been suggested that a compulsory denaturalization of pure fissionable isotopes may be agreed upon - they shall be diluted after production by suitable isotopes to make them useless for military purposes (except if purified by a process whose development must take two or three years), while retaining their usefulness for power engines.

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One thing is clear: any international agreement on prevention of nuclear armaments must be backed by actual and efficient control. No peace agreement

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can be sufficient since neither this or any other nation’s signature would
exist without trust into other nations’ signatures. Every attempt to impede
the international control agencies must be considered equivalent to denunciation
of the agreement.

It hardly needs stressing that we as scientists believe that any system
of controls envisaged should leave as much freedom for the peaceful development
of nuclearics as is consistent with the safety of the world.
The development of nuclear power not only constitutes an important addition to the technological and military power of the United States, but also creates grave political and economic problems for the future of this country.

Nuclear bombs cannot possibly remain a "secret weapon" at the exclusive disposal of this country, for more than a few years. The scientific facts on which their construction is based are well known to scientists of other countries. Unless an effective international control of nuclear explosives is instituted, a race of nuclear armaments is certain to ensue following the first revelation of our possession of nuclear weapons to the world. Within ten years other countries may have nuclear bombs, each of which, weighing less than a ton, could destroy an urban area of more than five square miles. In the war to which such an armaments race is likely to lead, the United States, with its agglomeration of population and industry in comparatively few metropolitan districts, will be at a disadvantage compared to the nations whose population and industry are scattered over large areas.

To believe that these considerations make the use of nuclear bombs for an early, unannounced attack against Japan inadvisable, if the United States would be the first to release this new means of indiscriminate destruction upon mankind, she would sacrifice public support throughout the world, precipitate the race of armaments, and prejudice the possibility of reaching an international agreement on the future control of such weapons.

Such more favorable conditions for the eventual achievement of such an agreement could be created if nuclear bombs were first revealed to the world by a demonstration in an appropriately selected uninhabited area.

If chances for the establishment of an effective international control of nuclear weapons will have to be considered slight at the present time, then not only the use of these weapons against Japan, but even their early demonstration...
may be contrary to the interests of this country. A postponement of such a demonstration will have in this case the advantage of delaying the beginning of the nuclear armaments race as long as possible. If, during the time gained, ample support could be made available for further development of the field in this country, the postponement would substantially increase the lead which we have established during the present war, and our position in an armament race or in any later attempt at international agreement will thus be strengthened.

On the other hand, if no adequate public support for the development of nuclear arms is available without a demonstration, the postponement of the latter may be doomed involuntarily, because enough information might leak out to cause other nations to start their armament race, in which we will then be at a disadvantage. At the same time, the distrust of other nations may be aroused by a confirmed development under cover of secrecy, making it more difficult eventually to reach an agreement with them.

If the government should decide in favor of an early demonstration of nuclear weapons it will then have the possibility to take into account the public opinion of this country and of the other nations before deciding whether these weapons should be used in the war against Japan. In this way, other nations may assume a share of responsibility for such a fateful decision.

To sum up, we urge that the use of nuclear bombs in this war be considered as a problem of long-range national policy rather than military expediency, so that this policy be directed primarily to the achievement of an agreement permitting an effective international control of the means of nuclear warfare.

The vital importance of such a control for our country is obvious from the fact that the only effective alternative method of protecting this country, of which we are aware, would be a dispersal of our major cities and essential industries.