August 15, 1978

President Jimmy Carter
The White House
Washington, D.C. 20500

Dear Mr. President:

As individuals long involved in the conception, design, manufacture, test, and maintenance of many of the United States' nuclear and thermonuclear weapons, we want you to know of our judgment on a question which has assumed considerable prominence in connection with the Comprehensive Test Ban Treaty ("CTBT"). That is the question of the degree of assurance in the continued operability of our stockpiled nuclear weapons in the absence of any possibility of testing with significant nuclear yield (for instance, with testing limited to laboratory-type experiments.)

As you know, the assurance of continued operability of stockpiled nuclear weapons has in the past been achieved almost exclusively by non-nuclear testing--by meticulous inspection and disassembly of the components of the nuclear weapons, including their firing and fuzing equipment. Problems encountered in this inspection are normally validated by additional sampling and solved by the remanufacture of the affected components. This program is, of course, supplemented by the instrumented firing of the entire nuclear weapon with inert material replacing the fissile materials, and the entire program thus far described would be unaffected by the requirements of a CTBT. It has been exceedingly rare for a weapon to be taken from stockpile and fired "for assurance."

It has also been rare to the point of non-existence for a problem revealed by the sampling and inspection program to require a nuclear test for its resolution. There are three acceptable approaches to the correction of deficiencies without requiring nuclear testing:

1) Remanufacture to precisely the original specifications.

2) Remanufacture with minor modifications in surface treatment, protective coatings, and the like, after thorough review by experienced and knowledgeable individuals.

3) Replace the nuclear explosive by one which has previously been tested and accepted for stockpile.

A fourth option, to replace the troubled nuclear system by one not already prooftested may result in improved performance, lesser use of special nuclear materials, or the like, virtues which have more to do with improvement of the stockpile than with confirming its operability.

We believe that the key question to be answered by those responsible for making and maintaining nuclear weapons is

> "Can the continued operability of our stockpile of nuclear weapons be assured without future nuclear testing? That is, without attempting or allowing improvement in performance, reductions in maintenance cost, and the like, are there non-nuclear inspection and correction programs which will prevent the degradation of the reliability of stockpiled weapons?"

08/15/78 Letter by Richard L. Garwin, Norris E. Bradbury, and J. Carson Mark to President Carter regarding nuclear weapons stockpile reliability under a Comprehensive Test Ban Treaty (published in the Congressional Record 08/16?/78). (081578LGBC)

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Our answer is "yes," and we now discuss the reasons why knowledgeable people may have answered "no" to seemingly similar questions.

First, we confined ourselves essentially to the question, "If the stockpile is not required to improve, can it be kept from degrading?" Others may have had in mind the normal work of the weapons laboratories, by which nuclear weapons are continuously made somewhat more efficient, less costly in terms of nuclear materials, adapted to new packaging requirements, and safer to handle--for instance by the substitution of insensitive explosive. We have participated in such programs and find them both interesting and useful. Were these "improvement programs" carried out long enough without nuclear testing, the weapons thus affected would indeed have uncertain performance; the solution under a CTBT would be to forego such programs in order not to sacrifice stockpile reliability to a desire for minor improvement in performance.

Second, it is true that certain deficiencies have in the past been corrected by the replacement of the affected nuclear system by another one, following a test certifying the replacement model as ready for stockpile. This corrective measure would not be available under a CTBT. But the examples normally cited need not have been corrected in this way; for instance one Polaris warhead problem could readily have been solved by remanufacture with an acceptable change of surface treatment on the component which had caused the problem. The change of nuclear system was not absolutely necessary for the correction of the problem observed.

Finally, it is sometimes claimed that remanufacture may become impossible because of increasingly severe restrictions by EPA or OSHA to protect the environment of the worker. We note that additional protective measures which might be an intolerable cost burden in the manufacture of cardboard or of lightbulbs or of aircraft brakes are easily affordable in connection with the nuclear stockpile. Thus if the worker's environment acceptable until now for the use of asbestos, spray adhesives, or beryllium should be forbidden by OSHA regulations, those few workers needed to continue operations with such material could wear plastic-film suits (supplied with external air) commonly used for isolation against germs and against certain pharmaceuticals. It would be wise also to stockpile in appropriate storage facilities certain commercial materials used in weapons manufacture which might in the future disappear from the commercial scene.

It has been suggested that under a CTBT a President or Congress or the Department of Energy might not provide funds for stockpile maintenance inspection and correction, or that a President might not provide a requested exemption from OSHA or EPA requirements. We see no reason to assume that the national security bureaucracy will not continue to serve the national interest, and we would welcome a statement in conjunction with a CTBT that non-nuclear testing, inspection, and remanufacture where necessary will be fully supported in order to ensure the continued operability of stockpiled nuclear weapons.

We believe that the Department of Energy, through its contractors and laboratories, can through the measures described provide continuing assurance for as long as may be desired of the operability of the nuclear weapons stockpile. We are making this statement available to others in the Executive and the Congress.

Sincerely Yours,

Norris E. Bradbury

J. Carson Mark

Richard L. Garwin

## BIOGRAPHIES

Norris Bradbury was the immediate successor to Robert Oppenheimer when, in 1945, Dr. Bradbury became Director of the Los Alamos scientific laboratory and served in that capacity for a quarter of a century until 1970. A physicist and member of the National Academy of Sciences, Dr. Bradbury was also Professor of Physics at the University of California during this period and is a recipient of the Legion of Merit and of the Fermi Award.

Richard Garwin has been a consultant to the Los Alamos Laboratory for almost three decades, since 1950, and is highly regarded in the national security community for his in-depth technical analyses of an extremely broad range of defense issues. A physicist and member of both the National Academy of Sciences and the National Academy of Engineering, he has served as a member of the President's Science Advisory Committee, as a member of the Defense Science Board and as a consultant to the Arms Control and Disarmament Agency, among other agencies.

J. Carson Mark was head of the Theoretical Division of the Los Alamos Scientific Laboratory from 1947 to 1973. This Division was responsible for, and played a key role in, the conception and design of U.S. nuclear and thermonuclear weapons in the fifties and sixties. He continues to be involved in considerations of weapons effects and with the problem of the maintenance of a nuclear weapons capability under nuclear test limitations.

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