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TO : C. L. ..., Manager, ... Operations ... DATE: 20 ...

FROM : N. E. Bradbury

SUBJECT: Nevada Briefings

SYMBOL : DIR

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1. There follow some suggestions for your use in your talk at the Nevada briefings relative to the relationship of the Nevada test programs to the weapon development program of the Atomic Energy Commission.

The primary responsibility for the development of new atomic weapons as well as the improvement of existing devices is carried out for the Atomic Energy Commission by the Los Alamos Scientific Laboratory. Supplementary work in this field is also being carried out by the Radiation Laboratory of the University of California at Livermore.

Research in the field of atomic weapons is always directed at getting the most for one's money (i.e. fissionable material) under the particular conditions required by the use or delivery system of the weapon. Accordingly, the LASL directs its efforts both towards increasing the efficiency of use of active material in a given weapon system, and to increasing the scope and flexibility of atomic weapons so that they be available for the maximum number of applications to problems of warfare.

Research on atomic weapons means, of course, not only research on the best ways under various circumstances to use fissionable material but research on the use of cheaper materials for atomic weapons. Thermonuclear reactions, sometimes publicly described as the H-Bomb, fall in this field.

Laboratory research and study can investigate nuclear phenomena or the other phenomena of potential nuclear weapons only up to the point before a nuclear chain reaction starts. There are two reasons for this: one, a chain reaction requires the use of expensive fissionable material; and two, after the chain reaction starts, one has an atomic bomb and it would be impractical to build and staff a new Los Alamos after every experiment!

With stand-in materials the LASL can investigate in considerable detail most of the behavior of an atomic bomb up to the time when, with real materials, it would actually start to explode. However, the explosive phase of the reaction is not only the most interesting and the most important phase, but it is the phase which is least susceptible

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to calculation. It involves temperatures as hot as the interior of stars and the properties of materials at temperatures, pressures, and densities obtained nowhere else on earth. Temperatures of ten million degrees, densities that would make a cubic foot of water weigh a ton, pressures of millions of atmospheres, and times of a hundred millionths of a second (the "shake") are commonplace in these circumstances.

As an example of how difficult the exploding phase of an atomic bomb is to calculate, one may go back to the Trinity bomb of 1945. After all the theorists had made their best calculations (really, their best guesses), they nodded wisely and said it will probably be about 5 to 10 kilotons. But it came out nearer 20. A few years ago the LASL made the most extensive calculation that could be devised using the most modern electronic computers of this same system. This time, however, the answer came out nearly twice as big as the bomb actually went. Clearly, only experiment can really say exactly what is going to happen and can point the way to real improvements in atomic weapons. This our empirical formulae cannot do.

The details of the Los Alamos and Livermore experiments are technically so complicated that little use would be served by describing their intimate details. None of these particular experiments are models of actual weapons although this is, of course, not necessarily true of the shots being conducted for other agencies. Moreover, all of the LASL experiments have as primary objects additional information (generally of many sorts) related to the process which go on when an atomic bomb explodes under one or another type of nuclear system. Thus, an extremely detailed and complicated program of experimental observations is both fundamental and essential and the actual "bang" or yield of the explosion is, in many cases, of secondary interest or of diagnostic interest in furnishing information as to what went on, and how, inside the chain reacting system.

The accompanying slide shows the list of bombs and the rather affectionate names assigned to them, the agency responsible for the particular test, and the probable yield. This latter figure, as indicated above, is not of significance in itself in experiments of this sort, but is mentioned here only to give some relative idea of how the size explosion which will be seen compares in appearance with the explosions from conventional weapons in the stockpile.

To give some idea of what sorts of fields are being explored by the LASL, the first and eighth shots, Annie and Harry, are primarily explorations of the hydrodynamics of the assembly of fissionable material and what goes on in the very late stages of this assembly, particularly if the initiation of the chain reaction is delayed.

Annie is actually the third one of a series, two of which have been conducted in earlier test operations. The result of the series will give us much information which can be applied to increasing the efficiency of use of fissionable materials in new weapons.

The second and seventh shots, Nancy and Simon, are explorations of scientific phenomena urgently needed by the LASL in connection with the research program on thermonuclear and related systems. These are not thermonuclear weapons; indeed, they have little relationship to any actual weapon, real or imaginary. They are actually pure nuclear experiments in the realm of temperatures and pressures which can only be obtained by setting off an atomic bomb.

The fourth shot, Dixie, is an experimental observation of a new and cheap method for initiating a nuclear chain reaction as well as furnishing more light on the question of when and how such reactions start.

The fifth shot, Badger, is an experiment to explore a potential new technique of not only increasing the efficiency of burn-up of fissionable materials in atomic bombs, but an exploratory experiment in the further use of cheap materials in nuclear explosions. Again, the device is not a weapon, but, if it works, the ideas found effective therein will speedily find their way into weapon application.

The two Radiation Laboratory experiments (Ruth and Ray) are explorations of the nuclear properties of certain systems, a knowledge of which may prove useful for both conventional and thermonuclear research programs.

It will be noted that most of the LASL shots are on towers rather than dropped as air burst bombs. This is primarily because of the detailed instrumentation which requires that not only the precise time of detonation be known, but that the device be exactly placed and that complicated instruments with electronic recording be in its immediate vicinity. With yields of the order of magnitude indicated, such tower shots can be conducted with complete safety. Only when the necessary information can equally well be obtained from a free air experiment are these employed.

It should be apparent that these tests cover a wide spectrum of atomic weapon research and development. They supplement in an absolutely essential way the laboratory investigations at Los Alamos. In reality the Nevada Test Site is only an extension of the physics, explosives, chemical, and metallurgical laboratories at Los Alamos to cover the temperatures, pressures, and other phenomena which can only be obtained by an actual atomic bomb explosion. To the LASL, Nevada

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is a fundamental and imperative part of the laboratory just as are cyclotrons and test tubes. One part supplements and complements the other in the continual race to make sure that the United States is always ahead in the rapidly expanding field of atomic warfare.

2. I have clearly only indicated ideas and possibly phrases which you may want to use. No attempt has been made to put this in any form which you could quote since I presume you will be speaking informally. Nor have I included any quantitative remarks on the stockpile gains which have arisen out of LASL work including these field experiments. This latter gets pretty classified but could be included in general terms if you wish.

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N. E. Bradbury
Director

Orig. and 1 cc - C. L Tyler
cc - J. C Clark
D. M. Stearns
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