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Livermore's Director Files

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"11-4.1 Program Letters" Folder

These are letters on the details of the overall Livermore programs which go back all the way to 1956 and on which I will begin taking notes in 1958. They are from the Director or someone on his staff to the manager of SAN in most cases and in some cases to DMA.

The first letter of interest is dated 14 Jan. 58 and is the last such letter from York as Director to Fidler. The lab programs are broken down into the following major headings: Fundamental research; general weapons research; specific device research and development; specific weapons development and engineering (on which this lab is in the early phases of building up a capability); test planning and evaluation; non-military uses (Plowshare had been initiated); and other programs (Sherwood and nuclear propulsion-Pluto). Note that in the area of specific device R and D, some fair amount of thought and design is going into cleaning up the devices

In the area of planned tests, 3 series are outlined for 58: 58A at the NTS in the spring to include 1 point test only; Hardtack at the EPG and 58B listed for NTS in the fall and including 1 point and full-scale tests. All of these 58 B tests are to be done underground and the tentative list includes 5 full-scale tests,

It is stated that "By increasing the yields of devices tested by a factor of 20 or so each time, it is hoped to reach the megaton range in underground testing by 1959. The radio-chemical measurements available in such tests remain subject to question, but accurate yield and prompt diagnostics appear from the Rainier test to be possible. It is hoped that most or all of the UCRL tests for Operation Trumpet (planned for 59) may be carried out in this way. To insure that this can be planned with assurance, a 20-40 Kt. yield shot should be made

in the fall of 1958." Note that planning at this stage for Trumpet includes some evacuated pipe x-ray measurements underground.

A supplement to the program letter dated 21 March 58 was written after Teller took over as Director and goes into possible studies, calculations, tests, and experiments, as well as specific ideas which Livermore has and cannot at the present pursue due to the limitations on manpower that they have to put on projects. After going into several pages of what can be done in each of the major program areas, Teller concludes "The above enumeration clearly indicates that there is far more useful work to be done than a laboratory of the present size of UCRL can possibly do in the immediate future. This poses the difficult and dangerous problem of choosing the ultimately most useful and desirable ideas from among the many promising and in some cases unexplored candidates. We feel that, at least at the present level. limitations of funds should not be the determining factor in our ability to pursue some of this work."

The next program letter from Teller following the beginning of the moratorium, dated 25 March 59, states "It is yet too early to evaluate accurately the effects of the test moratorium on the Livermore laboratory. Nor is it possible to predict how fast the science of nuclear weapons will progress if the limitations are to continue. New ways are continuing to be explored that will allow weapons technology to advance even without testing, but it is uncertain at what reduced rate new models of weapons can enter production and stockpile once the backlog of current committments is met. It is certain that if the moratorium continues, weapons will proceed at a much slower pace than that which was achieved in the past two years when testing was at its peak. The plans for future weapons development at Livermore include new techniques and facilities which will, in some small measure, offset the loss of the testing capability." As for test readiness,

"An attempt is being made to establish and maintain a capability of resuming tests on a relative short notice, either in a limited series of shots or in a full-scale operation. This state of preparedness is never an accomplished fact but requires the continual application of technical manpower and facilities for planning, designing, and limited fabrication. The preparedness effort, even though limited, further dilutes the support that would be desirable to put into the advance of new weapon designs. The resolution of any of the uncertainties regarding future testing will eliminate the need to prepare for all of the possibilities, and thus will enable the Livermore Laboratory to concentrate its effort more effectively in advancing the science of nuclear weapons."

The major heading of general weapons research is broken down into a number of experimental and theoretical methods to address some of the physics including: criticality studies by various methods; containment of very low yield nuclear reactions within a steel sphere; theoretical and experimental investigations of the possibility of concealing nuclear explosions; and x-ray and argus studies and data reduction.

The section on specific weapon and device R & D and design and weaponization includes much specific discussion of the various classes and kinds of weapons as well as the estimates of which ones could be stockpiled on what time time scales and which tests would be most desirable as of this date and the possibilities of change in requirements for nuclear testing in the future.

The general heading of testing planning and evaluation, which is Gerry Johnson's area, includes the sub-headings; test planning, diagnostic plans for test resumption, diagnostic instrumentation, basic studies of phenomena connected with diagnostics,

Jericho Test Program, and test operation support. Under the test planning section, it is noted that detailed plans are being developed for extended series of underground tests at NTS, and an opensea Pacific series not requiring the use of EPG as either a firing site or a staging area. Livermore "believes that the underground testing technique can be developed to the point where diagnostic information ~~xxxxxx~~ comparable with that from above ground tests can be obtained. Investigations are under way into new instrumentation and methods for obtaining high quality data from underground shots." This had led the laboratory to develop a program of tunnel excavation for shots up to 30 to 40 kt with studies under way for sites to contain up to 200 kt. "LRL has assumed that, if Continental testing is resumed, it will be underground and that even if atmospheric testing is permitted, LRL would plan to test underground for operational flexibility and with the anticipation that at some future date atmospheric testing would be prohibited." Also noted is that studies are under way to develop ways of testing in outerspace since this will be the only practical way to test megaton range devices in the anticipation of an atmospheric test ban. A number of problems in test diagnostics are being addressed and the Jericho program is aiming toward tests possibly in the spring of 1960. Further, in the area of test operations support, a portion of L Division is supporting proposed Plowshare experiments as well as preparations for possible test resumption.

The rest of the program letter addresses Plowshare, Sherwood, and Pluto programs.

Several letters specifically on the testing program were written in the next few months by the Director or Gerry Johnson. The first of these on 16 April 59 from Teller to Starbird followed a message from Starbird on 13 April that gave some guidance on the funding and preparedness limitations due to plans for no tests in FY 60 but limited readiness capability. Teller sets forth a test

program that Livermore would like to see pursued if testing could be resumed in the summer or fall of 59 and would take testing up thru Sept. 1960. In tabular form is presented those weapons developments shots as well as some Plowshare and detection shots which Livermore would wish to do with the site and device ready dates ranging from the 1st of June and fall for the devices thru 1960 and into 1961 in some cases. Over a dozen weapon development tests are specifically shown. After discussing at length the known geology of the NTS and the containment rules felt to be conservative (550 W to the 1/3rd for over-burden in tuff and 600 W to the 1/3rd for zero-point separation in neighboring tunnels), several tables of specific devices with the proposed tunnel site and the schedules for necessary construction to meet certain readiness dates accompany a detailed drawing of the configuration of the tunnels in Nevada to meet this list of some dozen and a half safety and full-scale weapons test. Noting that some immediate authorization for construction at the NTS would be needed to meet these schedules, Teller concludes, "As mentioned in the first paragraph, our suggested program is predicated on a change in these assumptions (limited funding and preparedness), and we would propose acting on it only in case the probabilities have altered so that those assumptions can be changed. It is an accepted fact that underground testing can be hidden. Considering that the U.S. has now made a proposal at Geneva which would allow underground tests for the time being, it seems appropriate to LRL to demonstrate that we are serious about underground testing by undertaking such a tunnel program now."

The next update is forwarded by Johnson to Starbird on 8 June 59 and lays out a specific program to begin testing with a 1 Aug. authorization and the first shot on 1 Nov. 59 (90 days readiness with the first shot 1 year after the moratorium began). The first three shots would be safety shots in tunnels I, J, and K whose construction is underway and has been authorized. The other 9 tests plus 3

contingencies which are listed would begin after the safety tests but the site preparation in some cases has been started but in most cases requires further authorization. Specific readiness preparations would cost some 3.6 million dollars in FY 59 and 5.5 additional million in FY 60 with an additional 9 million or so needed to prepare sites for actual tests once the go ahead for testing is received. 4 of the weapons test listed are called "heavily diagnosed" shots and would require about 9 months lead time to prepare the diagnostic experiments. By this letter, Johnson requests authorization be given to increase the tunnel preparations to meet the overall readiness program which would begin new construction just about immediately which would carry over well into 1960. A 22 June TWX reply from Starbird to LRL (No. 1041) states "Authorization for the proposed construction is withheld pending an overall review of the effort at NTS now underway. Presently authorized construction will continue until the end of June." Starbird anticipates an effort of lesser scope than indicated in the Livermore letter.

A 15 July 59 letter from Teller to Starbird responds to requests for information and proposals in development of tactical weapons with enhanced nuclear radiation and what the Livermore program is and might be. The type of weapon is defined as that which would have a large radius for radiation kill compared to that of blast effects

Teller sets forth the present lab effort in these areas and what would be required in the way of shift of personnel from other programs or additional hiring to meet various schedules for testing and preparation of these devices. Of interest, he states, "First of all it should be reiterated, that the most important factor to insure early stockpiling of some radiation weapons would be the prompt resumption of nuclear testing. . . . For the purpose of this discussion we will assume that testing

of yields in the range of a few kilotons and below will resume underground some time in the neighborhood of Jan. 1, 1960." He notes that the only other organization with the ability to work on these programs would be LASL and encourages that they get started on such things and mentions also that AWRE might be able to pursue these ideas and that some calculational support might be sought from Rand and possibly NYU. In summary, he says, "A careful but necessary preliminary planning of the development of radiation weapons has been carried out. On the basis of this, we believe that a rapid and reasonable development in this area will require cancellation of some and the delay of other important work at the laboratory, and will also require a moderate expansion (80 direct heads in the Whitney effort during the next year). . . . As a result we expect that an effective radiation weapon could go into stockpile not later than 1964. The lab would appreciate an early directive to proceed on an accelerated plan toward a development of the radiation weapons. Because of the heavy sacrifices required in any of the alternatives mentioned above and because of our manpower shortage we feel that we cannot make the acceleration of these developments without a clear directive." The Livermore mid-year review sent from Teller to Starbird on 16 July 59 contains a lengthy discussion of the impact of the moratorium. "In reviewing the program of the Lawrence Livermore Laboratory for 1959, the currect moratorium on nuclear weapons testing continues to be the most important factor. This handicap and uncertainty, combined with a heavy commitment to a number of very important weaponization programs, produce an anomalous situation in which both factors work to inhibit device development on advanced concepts, which is vital to the ~~xxxxxx~~ development of future weapons. This situation will be temporary as regards the balance between weaponization and device effort, and may also be temporary as regards the test moratorium, but, of course, it creates serious problems for LRL." After noting that Livermore regards nuclear explosives development as their most important job and that prediction of developments beyond five years is

meaningless, Teller continues "If testing does not resume, it will be necessary to development new techniques which ~~will~~ do not involve nuclear weapons tests, to carry us as far as possible in the development of new nuclear weapons. Depending upon the nature of the designs involved in the full yields desired, one can hope for a substantial measure of development. It is clear, however, that the rate of progress in weapons development would be very markedly decreased by a continuance of the moratorium, even if substitute development efforts were expanded. By more extensive and elaborate calculations, use of mechanical safing and a more liberal use of fissile material in device design, etc., we would hope even under circumstances of a complete moratorium to be able to make one or perhaps two generations of weapons development progress, at least in some areas. While the uncertainty persist, the lab is making a very extensive effort to ~~come~~ become and remain prepared for testing underground and in deep space so as to be able perform such tests if national policy so decides. We consider it our responsibility to be able, in such a case, to obtain the necessary diagnostic data. This constitutes our principal effort in the testing area which has been cut back from 350 during Hardtack to a level of the order of 150 direct personnel." The rest of the review notes ~~that~~ the details of lab developments in the various classes of weapons as well as other programs such as Plowshare, Sherwood, and Pluto. Noted is that some investigation has been given to the detection of tests in outerspace as well as the programs completed and underway for test detection underground.

The next program letter from Teller to Shute on 2 Feb. 1960 opens with some discussion of the main problem which is the lack of testing: no nuclear tests have now taken place for almost a year and a half. Any estimate of the probability of their resumption either this year or next involves considerable uncertainty. Therefore, the lab must make plans to cover the situation both in case of a resumption

of nuclear tests, and a failure to resume nuclear weapons tests, with or without an agreement on control. In general, the position of the lab is that progress in the development of nuclear weapons, of the variaties which will be described in a later section, can proceed only at a very much slower rate if nuclear weapons tests are not resumed (at least underground) in the near future. Some very important kinds of weapons involving really new ideas cannot be developed at all if no nuclear tests are allowed. However, the lab considers its function to be the most rapid development of nuclear weapons under whatever circumstances may be dictated by national policy." In a lengthy discussion of the weapons development and weaponization programs, it is stated that currently, "Just under 1/2 of the direct effort devoted to the program of nuclear devices and warheads is expended in the weaponization phase. We expect it will be necessary for this percentage to grow to rather more than half by Sept. 1960. (This would be if testing were not resumed.) Hopefully the weaponization effort would then become more efficient and the percentages could be reversed back into a majority in the development of advanced designs.

Under the major heading of test planning and development, Livermore's assumption that a resumption of weapons testing will have tests being only underground and completely contained is noted, with the exception of a later possibility of outerspace tests. "An increasing degree of confidence in underground diagnostic technology has also developed, and a continuing program of theoretical and experimental work will further increase the reliability and capability of our diagnostic techniques. We are continuing the excavation of tunnels at NTS to provide shot sites for yields up to about 30 kt. Preparation of specific shot sites has proceeded up to a point where the next step is scientific construction, particularly installation of diagnostic cables and bunker operating facilities. During the next two years, if such testing resumes, underground sites for testing in the 100-200 kiloton range can be constructed and used."

The lab's Succotash readiness program is presented in some detail with the first shots to be a safety and a proof shot and tests to be the highest priority tests to come sometime later. Specific programs in the development of diagnostic instrumentation detectors, techniques, data retrival systems, etc. are presented.

In the area of outerspace, "a feasibility study has demonstrated that such testin is practical and useful. A proposal for a test to establish the method has been submitted to DMA by LRL. After authorization to proceed, we estimate that in 18 months a test at 100,000 from the earth's surface could be carried out to calibrate the new techniques required for measuring yield, transit time, and other device properties." It is noted that this program go ahead would require the lab increasing its technical staff to support it.

The following are specific sections discussing programs which allow some progress in weapons technology without being allowed to test: computing machines, code development, flash x-ray and linear accelerators, hydrogen equation of state, and materials development.

Further program discussions address the Plowshare program to which a great deal of space is given, and the program for detection of underground nuclear explosions which includes planning and work underway for the Lollipop test in granite. Also details of the Cowboy program underway are presented.

review

The mid-year from Brown to Shute on 15 July 60 contains several significant items. "A new area (Area 410) is being set up at NTS for the purpose of conducting hydrodynamic experiments which cannot be carried out at site 300. This area should be operating in Sept. or Oct. of 1960."

In the area of Vela, there are several interesting points made. As for Vela Uniform, "Livermore plans to take no primary responsibility except for the Lollipop in granite, which may take place later in Sept. 60, and the decoupling shots which can be carried out sometime in 1961 depending on the size of the salt cavities which may eventually be decided upon. For these experiments LRL plans to take responsibility for staging shots and for coordinating close-in measurements only, immediate and distant measurements being the responsibility of others. For other shots LRL will serve only in an advisory capacity, concerning ourselves principally with the theory of coupling of energy from the explosion into the seismic waves. ARPA has overall supervision of the program. If no adequate program of nuclear explosions for measurement of decoupling is authorized, it will be desirable to carry out further chemical explosions at Winnfield with gaseous explosives." In the area of Vela Hotel, Livermore has received some money from ARPA to carry out studies on background radiation in space during FY 60. Together with lab programs for neutron albedo from the earth's atmosphere and neutron emulsion work in the Van Allen radiation belt, to be carried out in FY 61 and 62, these 3 programs have been proposed as a package to ARPA for possible

funding under Vela Hotel. "This would include x-ray as well as gamma ray and particle background measurement using detectors, expecially developed for the purpose, at altitudes characteristic of both high and low earth satellites."

Pertinent to the shift from readiness to Vela Uniform is the section: In connection with the device program and capability for readiness to test underground within 45-60 days was being approached in the spring of 1960. This was set back by the advent of the seismic detection program. Because of the seismic program it appears that the B tunnel will not be available for a readiness program. However, several sites in the E tunnel will be. The lab has in preparation a new proposal for a readiness program based on the assumption that the seismic program will be carried out."

The lower level of activity and support for Plowshare is indicated noting that Gnome is the only nuclear experiment for which construction authorization exists and that funding reductions have caused discontinuation of high explosive studies and a reduced level of certain feasibility studies. "In the meantime, we are determined to make Gnome as successful an experiment as possible, believing that a single successful Plowshare demonstration may very well affect decisions on the budget and authorization."

The next program letter came from Brown to Shute on 18 Jan. 61 and stated, "Since the moratorium on nuclear weapons testing has been in existence now for over 2 years, and may be expected to continue for some time in the future, the laboratories methods of weapons developments have had to be adapted to the situation. Very much more elaborate techniques of calculations and nuclear weapons design, along with a certain amount of laboratory experimentation have served as a partial substitute for weapons tests. The result has been very real and important but considerably diminished progress in weapons design and development. If testing is not resumed, we expect in the period thru FY 63 to proceed with

work on items

on which

some progress can be accomplished without tests."

Further on Vela and readiness, "The exigencies of the seismic improvement program have essentially eliminated the readiness capability for resumption on short notice of full-scale underground testing. We would hope to receive authorization and funds to restore this capability in the near future. If such testing is resumed, we would be in a position to test (and stockpile is successful) a variety of items

." (These include the developments mentioned above and devices.) After a discussion of the methods that have been used to certify for stockpile weapons significantly different from those stockpiled in the past, ~~for stockpile,~~ it is summarized that "The conclusions about weapon development which we have reached on the basis of the past few years' work and our anticipation of the next few year's work, one can say that the test moratorium has considerably impeded development both in thermonuclear and fission weapons design, that progress which is quite important militarily can still be made without full-scale nuclear testing, and that great care must be exercised in examining new designs before they are stockpiled in order to insure that they will function properly. The laboratory has kept approximately a constant number of personnel on weaponization and device design, which together constitute the weapons program. We expect that this number will not decrease during the next 2 1/2 years, in view of the weapons program which we foresee even without resumption of testing."

In noting the detrimental effect of the moratorium on the Plowshare program since nuclear explosions are not permitted due to political considerations, some contributions to the Plowshare program which have come from Vela experiments (Cowboy

decoupling shots) are noted. As for the Vela Uniform program, Livermore continues to be responsible for the Lollipop shot and certain measurements on other tests; and in the Vela Hotel program, the Livermore participation depends on ARPA support for background measurements in space.

Discussion of the weaponization program indicates that there is some evidence of a decrease in the weaponization workload and that "If the moratorium on nuclear testing continues, most of the released effort must be devoted to the more intense and more precise theoretical and experimental work required before new designs can be certified for stockpile."

The headings under test planning and development are: readiness, seismic improvement program, instrument development, optical instrument development, technical drilling, and containment studies. As for readiness, "The field preparation for the laboratories readiness program (Succotash) has essentially disappeared with the reallocation of the U 12B and U12E tunnels to the seismic improvement program. There remains a 30 day capability for 1 safety shot in U12J. Also, the basic construction has been completed in U12 E07. No further action can be planned to increase field (construction) readiness until funds are made available. The readiness activities at the lab have continued and will be maintained. The system I diagnostic equipment which was developed in conjunction with EG&G is complete. Capability for specialized diagnostic measurements will be maintained."

Under the heading of seismic improvement program is the preparation of instrumentation for the polyethylene yield experiment for determining yield on certain appropriate events in the Shade and Dribble programs. A Lollipop event is currently scheduled for the first of Aug. 61. Programs addressing the development of diagnostic and in particular optical instrument techniques and methods are detailed and a fair amount of attention is being given to telemetering broad-band information. Further, the drilling techniques at the NTS are being

worked on with attention being given to equipment and techniques for certain unique problems, such as line of sight holes, drilling into regions of elevated temperatures and pressures, drilling of shaped holes, and drilling into radioactive regions. Also being studied are containment problems and in particular a plan is being made for a proposal of an HE containment shot in granite.

Note that the status of Plowshare still had Gnome being planned to occur in Aug. of 61.

As near as I can tell in this 31 page report, no mention is made of the 410 activities.

An update of the Livermore programs is presented in a letter from Foster to Betts on 24 Aug. 61. Of the devices mentioned, only one "is now on the shelf awaiting resumption of nuclear testing." This is interesting in light of the discussions with Nielsen which indicated a late decision as to using this device for a nuclear test or finding any device that could be done on a short term for a nuclear test in late Aug. and early Sept. Foster notes that the Livermore programs for a short, medium, and long range test program have been submitted to DMA and also that the Gnome experiment will be ready for detonation in Dec. 61.

The final piece of correspondence in this folder is a 30 Sept. 61 letter from Foster to Betts which references several messages from DMA asking for Livermore's plans, proposals, etc. This letter contains details of a planned technical test program as well as device developments for the future. I will try to obtain a copy of this secret letter, No. BY 61-135, for our classified files. (IN "TEST PLANS" FILE)