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**Summary of Notes on a Meeting Held At Los Alamos, N.M.,  
3-4 March 1953, To Discuss CASTLE PLANNING With  
Particular Reference To TU-13 (DOD PROGRAM)**

Los Alamos Scientific Laboratory  
Los Alamos, New Mexico

March 1953

**NOTICE**

This is an extract of Summary of Notes on a Meeting Held At Los Alamos, N.M., 3-4 March 1953, To Discuss CASTLE PLANNING With Particular Reference To TU-13 (DOD PROGRAM), which remains classified SECRET/RESTRICTED DATA as of this date.

Prepared for:

Director  
DEFENSE NUCLEAR AGENCY  
Washington, D.C. 20305

1 JULY 1983

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## FOREWORD

This report has had classified material removed in order to make the information available on an unclassified, open publication basis, to any interested parties. This effort to declassify this report has been accomplished specifically to support the Department of Defense Nuclear Test Personnel Review (NTPR) Program. The objective is to facilitate studies of the low levels of radiation received by some individuals during the atmospheric nuclear test program by making as much information as possible available to all interested parties.

The material which has been deleted is all currently classified as Restricted Data or Formerly Restricted Data under the provision of the Atomic Energy Act of 1954, (as amended) or is National Security Information.

This report has been reproduced directly from available copies of the original material. The locations from which material has been deleted is generally obvious by the spacings and "holes" in the text. Thus the context of the material deleted is identified to assist the reader in the determination of whether the deleted information is germane to his study.

It is the belief of the individuals who have participated in preparing this report by deleting the classified material and of the Defense Nuclear Agency that the report accurately portrays the contents of the original and that the deleted material is of little or no significance to studies into the amounts or types of radiation received by any individuals during the atmospheric nuclear test program.

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ATTENDANCE

AEC:

M. Rex

AFSWP:

G. F. Blumda  
N. E. Kingsley  
H. Scoville

DLA:

N. Greenburg

DWET:

H. K. Gilbert (first day only)

J Div, LASL:

H. S. Allen (first day only)  
W. H. Burke  
R. H. Campbell  
D. Curry, Jr.  
E. S. Eumson  
A. C. Graves (second day only)  
P. L. Hooper  
A. W. Kelly  
W. B. McDonald  
W. E. Ogle  
R. J. Van Gemert (first day only)

JTF-7

W. S. Cowart  
J. L. Hall  
R. A. House  
C. H. Tyson

JTG 7.4

E. Gavin

HOL:

C. J. Aronson

OUR:

W. J. Thaler

## FOREWORD

While the Castle shot schedule has been markedly changed since the meetings which are the subject of this document, it is felt worthwhile to present this summary of the discussion essentially as it took place, without attempting to revise any comments as to shot participation, sites, and the like. However, it should be borne in mind that the schedule change will affect many of the plans made in these meetings.

The new schedule (as of 10 April 1953) is presented here for convenience.

<u>Shot</u>	<u>Tentative Date</u>	<u>Site</u>
1	2/15/54	Bikini—Surface Shot Over Deep Water—Barge
2	2/25/54	Bikini—Vicinity of Namu
3	3/8/54	Bikini—Vicinity of Yurochi—Barge
4	3/17/54	Bikini—Vicinity of Yurochi—Barge
5	3/24/54	Bikini—Enirman
6	4/3/54	Eniwetok—Eberiru

SECTION I  
CASTLE DEVICES AND LASL EXPERIMENTAL PROGRAM

W. E. Ogle

(NOTE: Portions of the discussion have been omitted in order to keep classification of this document as low as possible.)

A. SCHEDULE

The present schedule is as follows:

- |      |    |   |
|------|----|---|
| SHOT | 1. | Eniwetok, Vicinity of Elugelab or Rigili        |
|      | 2. | Bikini, Eninman                                 |
|      | 3. | Bikini, Barge or site on Yurochi - Aomoen chain |
|      | 4. | Bikini, Barge                                   |
|      | 5. | Bikini, Barge                                   |
|      | 6. | Eniwetok, Eberiru                               |

with the first shot planned for ~15 February 1954, subsequent shots at the following intervals: 7, 10, 10, 10, and 7 days, respectively. Intervals between shots are based on cryogenics, radiochemical sample analysis requirements, and geographical (atoll) locations.

B. MODELS

The FIRST is a shot, similar to Mike but with so that one would guess the maximum yield with a more probable number

Zero point for this shot is still uncertain. The proposal which is under study at the moment is for essentially the same site as Mike--up on the reef from Elugelab. It is considered more probable, however, that it will be either down the reef from Bogallua or close to Rigili. We hope this will be settled within the next few days. (The uncertainty concerns present radiation levels and condition of the islands around Elugelab.) This is planned as a surface shot, essentially on a man-made island.

SHOT 3 is Berkeley's first thermonuclear test.

Yield is expected to be so that there will also be a surface shot, in this case on land (Eninman) so that there will be an appreciable amount of dirt around it, as opposed to SHOT 1 which will be surrounded either by reef or water.

SHOT 4,

again on the ground, yield

It is presently proposed to be shot on a barge in the lagoon, 2500 yds offshore from the Yurochi - Aomoen chain in Bikini Atoll. There is a possibility that the Upshot series will indicate certain precise photographic measurements are necessary on this model which will require that it be in a fixed position. In this case, one would swing it around and anchor the barge on one of the islands in this chain, approximately the same distance from the gamma and photo stations.

The proposal at the moment is to fire on barges in the same general position as about 3 or 3 1/2 miles offshore, using the same photo stations as for that shot. If are fired, one of them would take the place of in the schedule.

(Incidentally, the water in the vicinity of the barge shots is about 30 fathoms deep.)

#### C. PROPOSED LASL AND UCRL EXPERIMENTAL PROGRAMS

As the group probably knows, there has been a reasonable amount of confusion as to what happened on Mike Shot. Up until a few weeks ago there were two values for the yield which were contradictory and appreciably different, yet no one could find anything seriously wrong with either of them.



All this has led to the desire to instrument one shot of this series in such a manner as to try to answer some of the questions which came up during Mike. After a great deal of debate, LASL has said let that shot be the

## I. SHOT 4

Thus, this test will include several very complicated sets of experiments, comparable to the sort of work that Krause and Felt did on Mike Shot. The set-up will involve 8 or 10 vacuum pipes (probably one which is 12 inches in diameter, the others 8 inches in diameter) running 2500 or 3000 yds to a recording station where various Ganex, Tenex, and other techniques will be employed to observe the reaction. On the other side, at a similar distance, there will be a photo station to do frame and streak photography.

These, aside from radiochemistry (which does not require anything in the way of close installations) are the major experiments. There are a number of other, smaller experiments: for example, attempting to count the neutrons which get out (supposedly, one can count the neutrons captured inside by looking at the materials in the samples collected); observing the gammas due to neutron capture in air, etc.

## 2. SHOT 5

The instrumentation on this device will use about the same techniques and set-up as for SHOT 4 there will be a gamma recording station

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and photo station at similar distances and in similar directions.

the then, will be instrumented almost as completely as

3. SHOT 3

The original intent was to instrument this test almost as highly as described above for

Frame camera photography will also be done, from a station probably on Aomoen. As noted above, if streak photography is necessary the test will become a land shot.

4. SHOTS 2 & 4

These models have on them essentially no requirement except for yield, which will be attempted by both radiochemical and ball of fire methods. It is planned to have photo stations on Enyu and Bikini, both of which can see the proposed zeros satisfactorily.

5. SHOT 6

Zero point is planned for Eberiru, and this test will have similar instrumentation to the Both detailed high-speed photography and detailed high-speed gamma observations through vacuum pipes are planned.

It should be noted that none of the bomb yields is guaranteed to within a factor of 3.

SECTION II  
ADMINISTRATION, LOGISTICS, AND CONSTRUCTION

A. POPULATION AND BASE FACILITIES - A. Kelly

Figures on estimated population are necessarily, at the moment, a rather wild guess. We are assuming that the LASL group (diagnostic experimenters and TG 7.1 headquarters) will total ~ 500, UCRL ~ 350 (with a question mark), and the military programs ~ 500.

Camps are planned for various places: the main camp on Parry, one on Eniwman in Bikini Atoll, a camp on Rojoa to take care of people working on the shot, and one up-island to take care of

It is hoped that the facilities on Parry will accommodate the number of people expected, and that the one on Eniwman, which was built for the construction phase, will be ample. One problem is what to do about the situation on Bikini after the shot. The plan now is to put all the people on ships, and it is hoped that this ship population can be held to something like 300. It is also hoped to keep the Rojoa population at about this figure.

It is expected there will be a peak of about 600 people from TG 7.1 on Parry (this includes UCRL, LASL, and DOD); that is, not all the people will be on Parry at one time, but will be spread out over the various camps.

These numbers are based on Ivy and do not include Holmes and Narver or the other Task Groups. Until we get some information on these other groups, it is difficult to tell just what the total population will be.

Further Comments - D. Curry

It is clear that the base facilities on Parry will be about what we had for Ivy, plus the additional complication of not knowing whether will be on the reef or up near Eberiru. If the latter, it is not known whether we can establish another camp up there. If we have to shoot over on the reef near Rigili, the commuting problem will be serious. (Possibly a camp can be established on Rigili.)

We expect to have an additional building on Parry for assembly of the devices, and will load them on barges there as well, so some sort of ferry slip will be constructed into which the barge can move for loading. The assembly building will probably be down on the south end of Parry and will take up more of our real estate, presenting a security and explosive problem.

As soon as we have fired the first shot on Bikini, we have lost our camp and air strip, and will have to live on ships. There is also concern about the contamination of the lagoon: we have a feeling that from the health standpoint the activity will probably not be too bad, but it will be considerably above the normal Navy standards so that the Task Force Commander may have to make an operational decision to let ships go into the lagoon.

B. MILITARY SUPPORT - D. Curry

Our requests to the Task Force include the following:

1. Army

The proposed number of Army personnel (to be based on Eniwetok Island) is 77 officers, 964 EM. Among the support which they provide is that of the Signal Company, Port Company (providing stevedoring at Eniwetok and also DUKWs), and the MP Company.

2. Navy

We have asked for an AGC (the Estes), an AV (the Curtiss), and a CVE; attached to the latter 6 to 8 HRS (helicopters), and 4 TBM (torpedo bombers). In addition, we have requested

an LSD (partly to support a boat pool and partly to provide transportation for the barges, possibly also for some dewar trailers from Eniwetok to Bikini)

2 LST. (one to establish the weather stations and to be available for transportation between Eniwetok and Bikini or to support the boat pool when the LSD is engaged in ferrying dewars and barges; the other exclusively for transportation between Eniwetok and Bikini)

3 ATF (fleet tugs, for towing and supporting DOD and LASL projects)

21 LSM

5 LCU

2 AVR

1 YCN (large barge, to be used as a helicopter landing, probably in the vicinity of Eniwetok or Bikini)

4 PEM (mainly for transportation between Eniwetok and Bikini, which will obviously be short once we lose our air strip).

In addition, we asked for one medium transport; the Task Force did not include it in their paper to the Joint Chiefs of Staff but are prepared to ask for it later on if it is needed.

### 3. Air Force

We have requested for intra- and inter-atoll transportation:

- 10 L-20
- 5 H-19 (the large 5- or 6-place helicopters)
- 3 H-13 (small helicopters)
- 4 C-47 (for lift between Eniwetok, Bikini, and Kwajalein)
- 1 C-54 (the General's plane—we can probably use it if we really need it, as we did the B-17 last time)

For Sampling:

- 10 F-84
- 4 B-57
- 1 B-36 (control)
- 1 B-36 (high-altitude)
- 1 B-52 (?)

Also:

- 10 B-29 (weather)
- 4 Search and Rescue planes

For Experiments:

- 1 B-36 )
- 1 B-47 ) (blast and thermal)
- 2 B-29 (canister drops)
- 3 B-54 (documentary photography)
- 1 B-52 (? - this is the same plane as the question-marked B-52 listed under the sampling plane requirements)

Also, there are the sample return planes.

These planes will all be based on Eniwetok Island for this operation. The 2000 men this represents, then, must now be housed at Eniwetok.

C. GENERAL

It is not planned to evacuate Eniwetok for any shot. However, there must be a real capacity to do so, in case of emergency. Should evacuation be necessary, it will almost surely be for more than a day.

As stated above, after the shot on Bikini everyone there will live on ships. A command decision has been made that there can be no manned stations on Bikini.

The Task Force Headquarters and most of the people associated with the airplanes will live on Eniwetok Island, so that while the number of experimental people may not be much larger than on Bikini (where there are actually more shots), the major proportion of the people will still be on Eniwetok.

The shots on Eniwetok will be fired from the same control building as used in the past, except that it will be enlarged. The shots on Bikini will be fired from a ship, as for Mike.

D. CONSTRUCTION - R. Campbell

Campbell explained the functions of J-6, the group at LASL which is responsible for collecting and coordinating requirements for instrument stations and other construction, power, timing signals, etc. From J-6, the requirements go to the AEC for approval, after which they are sent to their contractor, Holmes and Narver. Since the responsibility for providing the facilities requested (and seeing that they survive the blast, etc.) lies with the AEC, they prefer that H&N do the actual design work, rather than having separate experimenters submit their own finished designs.

The following chart will illustrate the urgency with which requirements for construction must be submitted, or they will not be ready in time.

TO GO (Months):

Work

11

1.5 months occupancy

9.5

4 months construction time

5.5

3 months procurement and shipping

2.5

1.5 months design

1

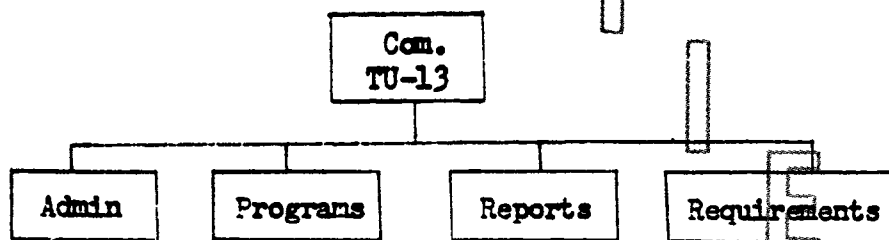
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Amplifying: we now have about 11 months until shot time. The normal time which experimenters ask for is a month and a half occupancy before the shot. The construction period on Ivy went from July through October, about 4 months. This operation looks bigger by about a factor of 3 (in that will each be about the equivalent of Mike in construction and facilities; the three barge shots are about like King), but with high optimism let us call this 4 months again. Normal procurement takes about 3 months (this may be more for difficult items), design about 1.5 months. So a month from today is the deadline for construction requirements on Eniwetok and Bikini.

It would appear that the only way the DOD requirements can be obtained is to have a member of that organization go around and collect them, working on this full time. Campbell suggested it would be helpful if this representative could spend a few days at Los Alamos familiarizing himself with the picture, what is available, the limitations, etc., then go see the various experimenters.

E. ORGANIZATION OF TU-13

Colonel H. K. Gilbert has been appointed as head of TU-13, with arrangements as described below for the next four months or so. The following organization is proposed:



Since Gilbert will be concerned mainly with Operation Upshot-Knothole in Nevada for the next few months, Captain N. E. Kingsley will act as his

deputy during that time and possibly throughout the operation. Captain Kingsley and Colonel Martell are assigned full-time to TU-13 at present, and there is a possibility of getting two more people from AFSWP assigned full-time.

Since Gilbert and Ogle will both be at NPG for the major portion of the next few months, it does not appear necessary to have a DOD representative at Los Alamos until after Upshot-Knothole. The "D-6" (counterpart to J-6 and Livermore's L-6 discussed above) man will presumably be Kingsley, at least for the present.

The final approval for the organization described above is pending a JCS paper, which has not gone through but is expected to. Gilbert would anticipate that the people in the Reports box would not go overseas. The Administration section might not be necessary overseas—DIET have found it is necessary in continental tests. It will never consist of more than one very junior officer and perhaps one enlisted man. In addition, so far as personnel overseas are concerned, there would be possibly a logistics man, as well as the construction man, in the box called Requirements.

Captain Kingsley may be contacted by writing to the Chief, AFSWP, (Attn: Capt. N. E. Kingsley), PO Box 2610, Washington 25, D. C., or in a week or so when they get set up, to Hq TU-13. His phone is 7-1300.

#### F. REPORTS

Curry is preparing a form for status reports, a draft of which he will show Kingsley, requesting the usual operational requirements except for construction.

As for experimental reports, Ogle will request a preliminary one very soon after each shot, and a final one as soon as the data are interpreted. This can be written as a report to the Task Group Commander, and he will not insist on reviewing it.

"Turquoise Book" for Castle: Sometime in July or August we would like to get together a book illustrating the whole operation. Ogle asked that Kingsley or Gilbert furnish a section covering the DOD program. Outline and format should be similar to Galentine's Ivy Turquoise Book.

#### G. PERSONNEL CLEARANCES

The AEC has the responsibility for taking care of Q clearances. Curry thinks it is safe to say that everyone working on these projects should have a Q clearance sooner or later—the sooner the better. As for crews of ships, it is thought the officers should be Q cleared, the crews not necessarily; they will get a P clearance.



SECTION III  
PROPOSAL FOR AIR BURST AND SURFACE SHOT OVER DEEP WATER

U The DOD has made two proposals for the Castle tests which they wished to explore at this time and if possible reach a decision on. These are:

A. N AIR BURST

Scoville described how this proposal arose. In the last meeting of the Committee on Atomic Energy, Dr. Bethe brought up the subject that he considered it highly desirable to airburst a large-yield weapon at approaching an operational height. This was discussed to a slight extent by the members of the CAE, with mention also of the advantages here for testing the whole delivery system as well as obtaining scientific information, and they recommended it be investigated. AFSWP representatives then talked with General Fields (Paul Fine and Col Huston were also there) and they said they would initiate the investigation of the possibility of having one of the shots changed from a raft to an air burst on Castle.

One of the primary reasons given by Bethe was evidence from Mike Shot that there was possibly some venting of the atmosphere. This evidence could also indicate refraction due to atmospheric inhomogeneities. One of the other interests from the military standpoint is an opportunity to compare thermal radiation results from King Shot with a larger weapon.

Ogle outlined the present status of this proposal. It reached LASL about two weeks ago and there was a meeting here of the people concerned. The conclusion of that meeting was that we are very much opposed to such a shot. There are two reasons. J Division could probably carry out the tests, but it would be much more of a load. The second and more important reason is that we have nothing to air drop within that time. The bombs that are to be prooftested at Castle will be built in such a manner that theoretically they could be dropped from a plane (e.g., they will have fins, etc.), but in fact none of the ballistics will have sufficient tests on them by that time. For example, the air drops on the systems will not be done until something like a year from May. We are unwilling to put on these bombs, which we don't know very much about, the additional uncertainty that comes about because of having to carry them around in a plane, then drop them and not know exactly what they are like the last half hour or so.

So, from the point of view of LASL, the bombs will not be in such a situation that the Laboratory would be willing to drop them. From J Division's point of view, we would have to carry both methods of testing forward, then

air drop them if we could, change to barges if the air drop did not appear feasible after tests.

Therefore, a letter has gone from Bradbury to either Fields or Dean, stating these things. Bradbury has since talked to Bethe, but the results of this are not known. Ogle can only put it this way: as far as the Laboratory here is concerned, we are strenuously against this. If Washington decrees that it be done we will air drop something—are not sure it will go off, it may stop some of the other shots and will almost certainly mean the other shots will be late, because we would have to concentrate on this one at the expense of the others. The feeling is that the over-all position of the country from the point of view of having these bombs will be worsened by such a test.

#### B. SURFACE SHOT OVER DEEP WATER

Scoville and Thaler explained the reasons for this proposal. First of all, the JCS have, in recommending the deep underwater shot, specifically said they would like to compare the effects of such a shot with a surface shot in deep water, this to see if the operational and development people can get away from depth charges, etc., altogether. (If they can do almost as well from the point of view of submarines and a task force array with a surface shot in deep water as with an underwater burst, this would change their concept.) Asked whether this is not amenable to calculation, Scoville replied that unfortunately there is no existing theory applicable to the calculation of underwater pressures from a surface burst because all the calculations break off at the boundary layer. Thaler added that some work is now in process with scaled charges, but it is not clear that results from this will be applicable to nuclear detonations.

Another point is that one wants to check the instrumentation that will be used in the deep underwater shot. Thaler explained that all the instrumentation will be checked by conventional explosives, but proper checks require a time constant which is not available from conventional explosives. The participation in this test would not be a field test of the instrumentation as such, but against the conditions obtaining in Wigwam.

The point, then, would be to measure underwater pressures at some depth at which submarines might be, at some distance on both this shot and Wigwam. The depth, according to Thaler, would be equal to or greater than 4 charge radii—this is 0.135 times the cube root of the charge radius for HE; for a 5-MT yield, the depth would be around 1000 ft.

He continued: the region of interest for submarines is in the range and having some estimate of the yield, they could calculate by scaling laws how far away the instruments should be. (Ogle pointed out

they had said earlier they did not trust scaling, then should use two bombs with about the same yield. Yes, they would prefer this, but must be opportunists. They have a range built into the pressure-measuring instruments to cover deviations from scaling laws.) Thaler argued further that in a lagoon shot one does not have an infinite medium, a generalization upon which scaling laws are based, but can have channeling, surface and bottom reflections, etc. He added that they intend to instrument one of the lagoon shots also, but for another reason (see discussion under Project 1.5).

There are more points: the whole contamination problem—for example, the scale work on base surge—indicates that quite a different effect may occur in deep and shallow water. Also, if one conducts an experiment in deep water, essentially a homogeneous medium, it is felt one could understand better the results from a shallow water burst, having done one good experiment which is analyzable.

Ogle agreed with these points in general, if they would just do this with a 20-KT shot (NOT at Castle). Thaler said he has talked with Hartmann and others who feel this is a good chance and should not be overlooked; they have confidence in being able to go from these results to predictions on smaller shots.

Porzel asked if the time duration of the pressure wave in the water is important. Thaler replied that it is, from the point of view of ship damage; the modes of failure are completely different if it is given an impulse or squeezed slowly. Porzel thought this would be so markedly different in a surface and underwater burst, perhaps by factors of 1000, that one could not scale with confidence. Thaler did not agree. Porzel elaborated: the phenomenology which occurs on nuclear explosions during the time the energy is being transmitted to the water is so different in the two cases that the resultant pressure wave may well not scale. In nuclear explosions this transmission undergoes a marked transition just about the time one gets down to the pressure levels which occur in HE, so that small charge scaling up to nuclear charges is really treacherous in this domain. Insofar as scaling for big yields in nuclear explosions is concerned, the peak pressures should reasonably follow pretty well defined scaling laws, but the durations he was not so sure of. If peak pressure is of prime interest, then it is a safe enough bet to trust scaling laws, but if the time constant is important, it is a dangerous thing to do.

The site recommended by the DOD for this shot is off the southwest corner of Bikini Atoll, about a mile and three quarters on the ocean side of Bokororyuru. Thaler has been looking into this and has found that the old Bikini-Charlie Seabee moorings are still good, will be for the next thirty years. A tentative mooring system has been worked out, involving two lines and a Sea-Hule engine to maintain constant tension on the lines. The Hydrographic Office has furnished information on wave height and

roughness, wind speed, etc: these numbers say the waves have a maximum amplitude of 2 ft (from crest to trough), and that the wind speed averages 20 knots, constant from the NE from about February through July.

So far as LASL is concerned, such a shot is not impossible nor does it involve major philosophical problems like the air burst, but it is considerably more difficult operationally. We would, in the first place, prefer a different site, one where we could use the same photo stations, timing wires, and gamma stations as for the other barge shots. However, the water is rough outside the lagoon at any place where this would be possible, we would not trust the presently proposed methods of putting the bomb on a barge and would probably have to use a ship.

As far as the bomb itself is concerned, one would probably talk of a The only experiment that we would almost certainly lose would be high-speed case photography, which can be done at the distances we propose, ~ 3 miles, with almost as good resolution as you like, but which requires a very small field of view and could not tolerate the barge's moving about appreciably. (It could stand 1 ft or so, but not 20 ft, for example.)

Assuming this was the the following would be required in the way of additional construction: another 10 or 12 miles of timing line; two new photo towers which would probably have to be built after the

This is very close to the location and might mean serious fall-out problems. In addition to probable loss of the high-speed photography, we would be in trouble on the telemetered alpha measurement, which uses a wire system: this we would either lose or have to run wires from somewhere close to the bomb through the deep water to a station. All these things are not impossible but would add quite appreciably to the cost and effort.

Asked for a quick (and unofficial) estimate of the additional cost with regard to instrumentation, Campbell would guess at a half-million dollars (this is the price of 2 towers plus 20 miles of wire). However, he felt a more serious difficulty than cost was the proximity of that location to . This means cables would have to be run and towers built between shots, troubles in mooring on hot islands, and loss of a photo station. This is about 9 miles from the and there are structures closer than that.

This subject was discussed again next day with Graves in attendance. The final agreement was as follows. LASL feels that this is operationally feasible and can be done, but cannot supply the extra money (in the order of magnitude of a million dollars) which it will cost. We will explore further from the logistic point of view whether, if the money is raised, the work can be done (e.g., see whether Spain can take on the additional effort). The DOD will decide whether such a test is worth that amount of money to them and if so, will see if they can get it. If they can, and our investigations indicate it is possible, the shot will be made in that manner.

It was further agreed that if such a test is done it will be the since this has the lowest predicted yield of the series. However there is one point: about a 50% probability exists that the will be fired. If it is not the shot will have to be one of the This will not be known until after Upshot. The DOD should plan, however, on a yield range from about 200 KT to something like 1 MT.

The Hydrographic Office has people available now who are qualified to go out and observe normal wave heights inside and outside the lagoon, correlate these with wind conditions, etc. Scoville thought it a good idea to send someone out now, since this is the same time of year, and Graves agreed. Scoville will talk with the Hydrographic Office and see what support is needed; Graves will contact Spain about this. In addition, H&N has a barge moored now at the Atoll with a man living on it, who will stay there for several months.

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SECTION IV  
DOD PROGRAMS

H. Scoville, M. Kingsley, G. Blunda, et al

A. GENERAL DISCUSSION

Ogle began the discussion by remarking that he had read the papers on the DOD proposals and thought it clear that in some cases there may be overlaps in that several experiments will get the same data, in which case it behooves us to correlate this as much as possible.

For instance, we will be doing some thermal work. We do not plan to do any total thermal measurements because we are not convinced that LASL can learn anything from this work which is applicable to our particular interests. We will probably measure power-time. Most of the thermal work will be concentrated in the and is largely devoted to an understanding of the physical processes going on in the air at that time. This is not pertinent to effects considerations and is probably not of concern to the DOD.

Probably the only other place where there might be duplication is in the program for measuring total number of neutrons. There our plans are not at all fixed yet. We are not convinced we can make any measurements by techniques used before and get an answer that we need. This is largely due to the fact that the neutrons, of course, have comparatively short mean free paths in air and we do not think we can talk of recovering inside 1000 yds from most of these bombs, so that the error introduced by having to extrapolate back to the bomb probably makes the measurements too crude to yield the information we need.

Scoville presented a little history on the DOD program as it stands today. An outline of a program was presented to the RDB on 17 December. Their new policy is to approve a program in general terms, rather than project by project, so that approval was obtained in December from the RDB of a rather generalized program covering the measurements that were considered necessary as of that time. Since that period, the projects have been discussed in considerable detail with various agencies that might

make the measurements and were interested in the results, details were worked out and the result is the program as it will be presented today.

After the RDB approved this program they went to the Secretary of Defense and asked them to release the money (five million dollars of R&D funds). Then there was a change of administration with a new economic policy, and it became necessary to resubmit the proposal. At the moment the program is again in the RDB office; it is not thought they will review it again but will probably send it back recommending the money be made available. On the other hand, the DOD cannot count the dollars in hand until they get them. There is a certain amount of so-called preliminary planning money which can be committed now for projects which are certain to be carried out.

(It would appear that the only thing we can do today is to go ahead on the assumption that the projects will get their money, and do the best we can if some of them do not.)

The program includes two projects which were not approved by the RDB in December but were left tentative pending more information. (AFSWP specifically earmarked these two projects as being open to question.) One was the long-range detection program, on which approval was left pending until the next CAE meeting which was on 10 February. The question here concerned evaluation of the programs, in part because of the tight security surrounding this work.

The other project was the BuShips proposal to evaluate atomic warfare countermeasures by using two drone-operated Liberty ships, one of which would be fully equipped with all the devices which have been worked out to protect and decontaminate Naval vessels, the other one not so equipped. They would position these outside the blast range but within the range where they would be surely contaminated. The proposal was not approved the first time, but was resubmitted with more details and was then approved by the CAE. This, then, should be added to the program as originally approved. (For further discussion of this project, see 6.4, below.)

The rest of the afternoon was devoted to going through the programs, project by project, with Kingsley conducting the discussion. He explained that he only got into this last Thursday, so would call on his colleagues where necessary. As stated above, the program was developed last fall, requesting the services to submit their concepts of what programs they needed, the results being worked over by AFSWP, consulting with the services and the various laboratories, and boiled down into an integrated program. The outline presented today was predicated on four types of shots: surface bursts on the ground, in deep water, and in the lagoon, and an air burst.

## PROGRAM 1 - BLAST MEASUREMENTS

### 1.1 Blast Measurements by Photography (NOL—C. J. Aronson)

#### 1.1a Free Air Pressures (Rocket Trails)

#### 1.1b Precursor Phenomena (Rocket Trails)

#### 1.1c Base Surge Phenomena

Asked the reason for making free-air pressure measurements, Elunda replied that this is just about a routine measurement with them, in other words, they feel that in the indefinite future they should get this at every opportunity they can. If there is an operational reason on some particular shot for not making these, they might be willing to give a point.

It was agreed that the object is to get in the state where one can predict with the accuracy desired. However, they do not think they are in that state yet, for high-yield weapons.

Porzel stated that as far as the values on Mike are concerned, even the enormous perturbation which enters because of its being a surface burst makes very little difference. The details, the rate of change of the fireball growth curve, are typical on Mike of a bomb situation, in beautiful agreement with King on the fireball and with the raw data as measured by rockets on King. He felt the Mike results demonstrated the basic validity of the scaling laws.

Ogle suggested that while this measurement may not yield much more information than is already available on the ground, it might give valuable data from higher regions which are in a variable atmosphere. Aronson did not think the rockets would go up high enough for that, but said this is a comparatively simple experiment and one should not throw away data.

### 1.2 Air Overpressures as Function of Time and Distance Along the Ground (HRL, SRI, Sandia)

This would be similar to Cox's work on Ivy, and is proposed on about the Mike shot scale of effort as a check point on 1.1. Ogle questioned this on the basis that there seems to be reasonable agreement on Mike between prediction and measurement. Scoville said this is not true in higher pressure regions. Porzel said the mortars caught some of these and they do agree—he thought what the DOD meant was not higher pressures but further out, and this has to do with varying atmospheric homogeneity. Ogle commented that the things having to do with atmospherics need further investigation.



Scoville agreed that if one can predict within 10%, measurements were not necessary, but he did not think this is true yet. Blunda felt that if the RDB approved this and it does not interfere with diagnostic measurements, its inclusion should not be argued. He pointed out that we only have data on one large-yield surface shot, and recalled the Buster blast measurements. Tears flowed like wine.

Cox proposed to go up to about 200 psi for these measurements, since he had no faith in the Ivy measurements over 20 psi. BRL, SRI, and Sandia have all expressed interest in this work. One of the proposals for measuring this on the water shots is to measure the rate of travel of the shock along the water photographically. (All agreed that this is a desirable method, clean and simple.) Also, BRL will proof-test at Knothole some 60 self-recording pressure-time gauges, which should take some of the strain off the instrumentation.

Blunda wished to add that if the DOD measurements can all be done at Bikini, they would have no program on Eniwetok.

Ogle was still not convinced much instrumentation should be included, agreed that some was warranted.

### 1.3 Free Air Pressures as a Function of Time (Parachute-suspended Canisters) - (AFCRC)

This project has been carried by AFSWP, was not presented as a requirement by the Air Force. They would want it definitely if there is an air burst; if not, AFSWP would ask the Air Force to re-examine it and recertify that they do not want this test. If they are satisfied with the Mike results, AFSWP would not push it any further. They should have that decision next week for a surface shot.

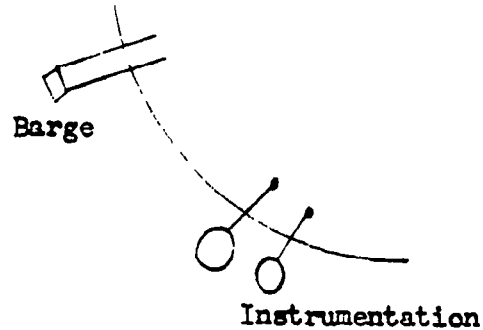
### 1.4 Shock Winds and Afterwinds - (Sandia)

Cox has said he feels there should be a check on his Mike results, and Scoville thought this would involve instrumentation at two stations. There is interest in the precursor stage, which is of more importance on an air drop but Thaler thought that even on a surface burst there is a definite chance of a precursor, if there is enough thermal flux ahead of the shock wave.

### 1.5 Underwater Pressure-Time Measurements - (ONR, NOL)

These have already had some discussion (see Section III, B). They are desired both in the lagoon and for the deep water shot, as stated earlier, for different reasons—the lagoon work is in connection with harbor defense interests.

Thaler explained his plans for instrumentation. For the surface shot in deep water, positioning would be something as in the sketch, with two strings, eight pressure-sensing elements per string, enabling a depth variation from a region 200 ft down to 1000 ft (the interesting region for submarines).



For the lagoon measurements, they would participate in the shot recommended by LMSL as a good one, using a series of stations (probably three, possibly four) which would contain probably six to eight pressure-sensing elements per station, and in addition employing ball crusher gauges for peak pressure.

The pressure-sensing elements would be mounted on tuna cans (weight ~ 1 ton apiece), design of which will begin just as soon as Thaler gets back to Washington. He added that he would be unwilling to do this experiment if they chose the other location (north of Bikini) for the shot, since the water there is so rough it would mean working in 9 or 10 ft swells.

Aronson stated that NOL is considering adding a number of channels to this measurement to get more data points.

#### 1.6 Acoustic Pressure Signals in Water - (ONR)

This is an off-site experiment, involves no personnel nor instrumentation in the Atolls.

#### 1.7 Water Wave Studies - (ONR, NOL)

Interest is in such measurements in both deep and shallow water and also for some measurements going up a beach.

#### 1.8 Close-in Ground Accelerations (SRI, BRL, Sandia)

Everyone is agreed this should be very limited, but should be done.

## PROGRAM 2 - NUCLEAR RADIATION STUDIES

### 2.1 Gamma Film Dosage Measurements - (ESL)

### 2.2 Gamma Radiation Dose Rate vs Time - (ESL)

It was agreed there is probably no point in making these measurements on the Berkeley bombs since they do not represent an operationally significant situation. Scoville said it was his thought that LASL would cover the very early interval, and they are not particularly interested in the high-speed radiation except to separate the two categories (i.e., did it come quickly or as a result of fall out). Malik thought they should be interested in this so they could give data on the source to Rand or someone to calculate it, with regard to effects on aircraft and the like. Ogle ~~stated~~ that LASL will make these measurements only on and

ESL will use the equipment employed by Costrell in the past, with even slower time resolution than before. The devices will be self-contained, with no telephone wires this time.

Dose rate vs time measurements are planned only for Bikini.

### 2.3 Neutron Flux and Spectrum Measurements - (NRL, NRDL)

Eliminating the air burst, this is planned for only one surface shot. (LASL will make such measurements in as great detail as we know how on Jughead; Ogle did not know whether we would do it any place else, nor did he think UCRL planned to.)

Scoville thinks it is a question of getting the people who will do this for the DOD and the people here together and working out a combined program. Malik suggested this is also true for the gamma projects.

The reason for this project is that DOD just do not have any data on this, and also want to tie it into Project 4.1.

### 2.4 Neutron and Gamma-ray Shielding - (CRL)

Scoville stated it was their feeling this has rather limited value; on the other hand, the effort involved here if someone else is measuring the neutrons consists only of putting in a few more detectors.

### 2.5 Fall-out Distribution Studies - (NRDL, CRL)

To be done at Bikini. This measurement will duplicate the DAN buoy work on Mike (except that results were disappointing on Mike because the

fall-out did not fall where it was expected to). The RDB rated this project very highly, and Ogle would agree with this.

## 2.6 Radiochemical Analysis of Ground Contamination (Off-site Lab Studies) - (NRDL, CRL)

This pertains to study of the samples from 2.5. A great many agencies will be interested in these results, and it was Scoville's feeling that the people who want the ultimate answer should analyze the fall-out samples.

## 2.7 Early Cloud Sampling Techniques

Scoville explained that this project had been put in as a result of discussions with Graves in Washington. The thought was that probably in the time available for Castle one could not develop a system which would be the final one for cloud sampling, but that various approaches could be investigated. He thought the primary requirement for this work would be from the two AEC laboratories (LASL and UCRL). The DOD does have an interest but it is more minor: in order to analyze the fall-out problem properly, they need to know the distribution of radioactivity throughout the cloud at about the time the cloud becomes stabilized. However, if the questions were answered from LASL's point of view, this would satisfy the DOD requirement as well.

Two groups have been asked to look into it: the Chemical Corps has contacted the Army guided missile people, and NRDL, the Navy missile people.

After discussion, it was decided that this project should be dropped from the DOD program, since it is primarily of interest to the people who use the samples, and that LASL should be charged with the responsibility of carrying out investigations of this nature. Hooper stated that LASL has already made plans for Castle sampling to fulfill the requirements of the Chemical Center, LASL, AFOAT, and UCRL: there will be one high-altitude sample (up to a maximum of 55,000 ft), other samples between 43,000 and 53,000 ft, to be collected with manned aircraft.

SAC is prepared to make a theoretical study of this problem also and, at our request, will investigate the possibility of guided missiles.

## PROGRAM 3 - STRUCTURES AND CRATERS

### 3.1 Loading and Damage to Structures - (OCE)

It is desired, if possible, to study the pressures on the OCE's multi-storied building on Engeb, the 3.1.1 structure of Greenhouse.

Mcoville said they had talked of doing this on Mike Shot, decided it was not worthwhile, and now wished they had done so. However, if the shot is moved to Rigili, they would drop this.

This project also involves construction of a cubicle duplicating the 3.1 Knothole cubicle, to be near the OCE structure. If the shot moves to Rigili, they would want the cubicle on Bikini.

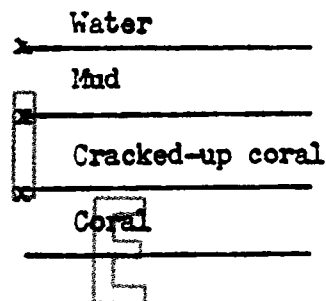
Ogle suggested that unless they want measurements in conjunction with the old OCE structure, it would be much better to do them on Bikini, since Engebi is still quite hot and there would be trouble instrumenting the structures. They agreed that if they could not instrument the OCE structure, either because Engebi is too hot or because the shot is too far away, the 3.1.1 portion of the project would be out but they would still want the cube on Bikini. This structure is to give one check point with the Knothole test and is all that is proposed in the line of test buildings. Location desired for the cube is in the 20-psi region.

### 3.2 Crater Survey and Evaluation - (EHL)

(Only the survey part bears on the operation overseas.) The DOD are anxious to get all the crater data they can, would make what surveys they could within the lagoon on the island and lagoon shots.

Ogle would argue that this is an automatic thing anyway; we have to know this, so we request H&N to make these surveys and they have done so in detail in the past. He asked if this were not enough, why make it another project?

The DOD plans were to get photography using the Army Map Service personnel, as soon as possible after the shot before there has been any back-filling of the lip, etc. They would then use a small boat to make a traverse of the crater when this became possible, using a fathometer to get points at the interfaces indicated in the sketch. The objection to a late survey is that this would measure only the apparent crater instead of the actual one.



The difficulty of getting in early, because of the contamination, was mentioned, and the point was made that there was really no hurry, just so it happened before the next shot. Porzel thought one should make the survey as early as possible because there is evidence that the Mike crater shifted quite a bit for several days. Blunda agreed, and explained how

important this is with regard to harbor considerations and the like. They wish to get a correlation with HE work—in this connection they would, of course, prefer a shot on the bottom but would try to correlate different types of bottoms with HE shots.

U Hunda saw no objection to letting H&N do this work if they would do so as soon as possible and if it were tied down as a project so they would write a report on it. He thought emphasis should be placed on the fact that this is an important effect.

N If the DOD did this, Kingsley would guess it would require something of the order of two people and a boat. The photographs include aerial photography and Ogle asked if they would be willing to let Lookout Mountain take the before and after pictures. Scoville guessed they would.

#### PROGRAM 4 - BIOMEDICAL STUDIES

##### 4.1 Neutron Dosimetry with Mice - (AMCGS, NRDL)

Scoville explained that this is different from Carter's project in the past where he measured the mean lethal range. The object here is to put out mice at distance increments that might be important from a military point of view—never mind if 100% get killed at one place and none at the next—the object is to correlate the physical phenomena with the biological response. Scoville said he was sorry to admit it but they do not have these data, and this is the only place he would say that a biological method is better than a physical one.

S Ogle mentioned a point which he was sure they were aware of: as the yield goes up, the blast and thermal effects become more serious relative to neutron effects, so that if mice are placed where neutrons will hurt them they will be killed by blast and thermal. He thought there were enough neutron measurements made on Mike that this information could be gained from them. (Scoville pointed out that AFMFP do not have the Ivy neutron data, and they are quite anxious to get it.) Ogle thought to get the dosages one would want, the mice would have to be around 1000 - 1200 yds; the high-energy neutron flux will not be much greater than from Mike, and 1000 yds would be right in the crater. It seemed to him that they must be talking of what happens because of the difference in neutron spectrum from a fission bomb. To find this out, one would have to be in a region where there is an appreciable high-energy neutron flux and because of the air attenuation, this must be close.

Scoville said that he had not seen the data from Mike yet. For a 20-KT bomb, one gets a lethal range of neutrons at 1400 yds. Was Ogle saying that for a 10-KT bomb the lethal range is the same? Essentially,

replied Ogle, as far as fast neutrons are concerned. Scoville stated that if this is the case, there is no point in the experiment. He would say that before they plan further on this, they should see the data.

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If 4.1 is done, it will apparently not be necessary to have the mice born and bred in the Pacific—Scoville thought they would be content to fly them out and back. They would, however, probably want to do a spleen-thymus study at the Atoll, and would require lab facilities and housing for the mice.

The agreement was to leave this project tentative, and they will re-examine it in the light of data to be furnished by LASL. It was Scoville's feeling that in view of Ogle's comments there is probably no point in doing the experiment; however, both medical panels were quite in favor of this, and it is the only biomedical project.

#### PROGRAM 6 - SERVICE EQUIPMENT AND TECHNIQUES

##### 6.1 Evaluation of Indirect Bomb Damage Assessment Techniques - (WADC)

This is planned for all shots, and is done more or less automatically. Continuation of the work is desired by WADC because they are continually modifying their IEDA techniques.

##### 6.2 Effect of Blast, Gust and Thermal Radiation on Aircraft in Flight - (WADC)

A B-36 and a B-47 have been requested for these measurements. No drones will be used. Ogle had no question as to the desirability of the measurements in general, but suggested they might better be made in Nevada. Scoville replied that the relative effect of thermal and blast effects would be different on these shots.

### 6.3 Electromagnetic Effects - (ESL)

AFSMP wishes to re-examine this project. The proposal came in before Ivy data were reduced, and Scoville stated that if these data are sufficient they will not want to do this again.

### 6.4 Proof Testing of Atomic Warfare Countermeasures - (NRDL, CRL)

As discussed above, this is the BuShips proposal to test the techniques having to do with decontaminating a ship, involving vent closures, spray systems, etc., and would entail two drone Liberty ships, one equipped with all the countermeasures, the other not so equipped. It is apparently quite important to the Navy, since further design and production of these devices will hinge on the results. They discussed having the ships manned and further away but decided the data to be gained by putting them closer and using drones were worth the increased cost and effort. They want them inside a possible base surge, if there is one, but sufficiently outside the blast range; distances like 6 to 10 miles are being talked of. The ships must be moving since the spray system operated only if there is a relative movement to the vessel.

Ogle asked why it was necessary to test these countermeasures close to a bomb, why not spray them with debris from a pile? Scoville replied that the activity must be in aerosol form, the way it is received from a shot.

The greatest problem here is an operational one with regard to the drone control. Cowart stated that the Task Force has discussed this—there has been consideration of controlling the ships by a plane flying, or from another ship—and have concluded it will require a clear channel system, a group of radio frequencies (the number not yet determined), in order to ensure safety. There is also a requirement for a helicopter to take the crews off before shot time which would be in addition to the requirements already submitted.

The seriousness of the frequency problem has not yet been investigated, but it would appear that if this can be solved the project can be carried out. Scoville thought they wished to participate on the deep water shot and one large raft shot, so as to have one clean situation and one crudded up with coral, for application to harbor studies.

It was suggested that this project should bring along a third ship (e.g., an APD) as part of their package deal, for control and to house the crews and experimental personnel.



PROGRAM 7 - LONG RANGE DETECTION (AFOAT-1)

7.1 Electromagnetic Radiation Calibration

7.2 Detection of Airborne Low-frequency Sound from Atomic Explosions

7.3 Seismic Measurements

These are all off-site projects. No particular comment except that it would be nice to find out what happened on Ivy.

7.4 Calibration Analysis of A-Bomb Debris

This project involves aircraft based at Eniwetok, and is done in conjunction with the LASL radiochemistry work. AFOAT-1 takes gas samples, get several inches of Spence's filter papers, etc.

PROGRAM 8 - THERMAL MEASUREMENTS

8.1 Thermal Radiation Measurements - NRDL

Scoville stated they had talked with Stewart last week and he made the statement that if LASL had no objections he would like to measure the total thermal energy as part of his LASL Castle program, that it would not be too much extra effort for him. If he does this, the DOD will cancel this whole program, since 8.1 is the only project.

This arrangement is satisfactory to LASL and it was so agreed. Stewart will have instrumentation on four of the six shots, the plans largely concerned with early times but once the stations are there the total thermal measurement will be no problem. He will measure atmospheric attenuation anyway because it is a photographic requirement.

This agreement is on the basis of no air drops. Should there be such, Scoville felt there should be more instrumentation.

The DOD is interested in the power-time measurements, but did not plan a project for it since LASL will make these studies. As for measurements from a plane, their feeling was that it is not worth the effort of making this measurement in the air—they are not concerned with the thermal radiation as a function of distance, how it got there, nor the atmospheric transmission, all they care about is how much flux was received and its effects, and feel this is adequately covered by Project 6.2. Stewart also told them he would make a calculation for them based on his surface measurements. Ogle agreed that if one knows what the plane received, he can probably figure out the attenuation as well as it is needed. The only other point which would

make him interested in an air measurement has to do with the geometry effect, which in principle one can also calculate with no trouble. That is, if one is on the ground he is looking at one quarter of a sphere, if up in the air, at a hemisphere. This apparently showed up quite strongly on Mike, but as he remembered it it came out about as calculations would indicate.

Scoville said the DOD would put up a small nominal sum for this program.

#### PROGRAM 9 - SUPPORTING MEASUREMENTS

9.1 Technical Photography - (EG&G and Signal Corps)

9.2 Timing Signals - EG&G)

9.3 Meteorological Documentation

Ogle questioned why these should be designated as projects, since they appear to be more in the line of support functions. For example, the timing and firing work has been set up as a separate task unit. Photography can probably be handled as it was for Ivy, since EG&G are in this already. The Task Force will supply a large weather service which should be sufficient, and there are also requirements for certain atmospheric conditions at shot time because of the ball of fire photography.

Scoville replied that for them this was an organizational problem, they must get money appropriated for these services and have to account for the cost. They have also found it useful to have one person worry about and coordinate all requirements of this sort. Therefore, they would like to keep this program for administrative purposes, but would not require reports.

There will be a large number of requests for photography from the DOD experimenters, among them Aronson's blast projects (this will include aerial motion pictures for shock velocity over water and base surge); crater survey; locating Thaler's buoys. The present plan is for photo stations on Bogallua, Parry, Hikini Island, Enyu, and very probably the Mack coral head. There is also the possibility of having the same sort of stations as were on Engehi for Mike shot, that is, cameras in steel boxes for which we furnished the concrete bases. This might be done in a few places where signals are available. EG&G will do aerial photography from the point of view of cloud coverage.

The DOD would like to have EG&G do their photography, had mentioned the Signal Corps just in case EG&G were too busy to do it. Aronson would like to contact them directly, especially since one may possibly need to activate additional camera stations. (Ogle said that at the moment we probably know their plans better than they do.)

Scoville was reasonably sure the Task Force can furnish all the meteorological data they need; it is just a question of collecting the requirements from the various projects.

B. KINGSLEY'S SUMMARY OF FOREGOING DISCUSSION

(The following is probably not verbatim, but quotes and the first and second person pronouns are used for convenience.)

"Program 1: You feel that 1.2 should be limited in number of stations as much as possible. This is a check on photography."

(Blunda: "Can we make that 'we take sufficient stations to augment the Mike data'?" )

"Program 2: No exceptions. It was our voluntary agreement to re-examine 2.4. Project 2.7 is to be dropped if you inform us that you are doing this work. Furthermore, the people are to get together (LASL and DOD experimenters concerned) and discuss this."

"Program 3: No exceptions. It is understood that the 3.1.1 structure will not be instrumented if the shot is on Rigili. The other structure (the cube) will be on Bikini."

(Ogle: "Let Lookout Mountain do the photography.")

"Program 4: We will re-examine." (Scoville again requests Ogle to send them the pertinent data.) "Probably the project will be dropped."

"Program 6: No exceptions from you. We will re-examine 6.4 ourselves."

(Curry: "I would like to mention in regard to the drone ships—if it comes to a question of a control ship rather than a control plane, the Estes, the Rendova, and the LSD all have other jobs, so if rehearsals are done, you will need another ship. I don't feel we can use one of the ships already requested." It seemed to Ogle that 6.4 depends upon a statement from the Task Force as to how serious these objections are. Cowart stated that they have looked at it; if someone has the money and the frequency problem can be solved, they can do it—but he thought the frequency problem is serious. Ogle remarked that at least two of these shots will have television monitoring of the DD systems, which will take up a good-sized band. Hooper wanted to mention that last year we overloaded the electronic system aboard the Estes rather dangerously, wished to emphasize more than ever for the DOD to think in terms of a support ship for the two Liberty ships.)

"Program 7: No exceptions."

"Program 8: (Only Project 8.1) - we are dropping, with the understanding that LASL will make total thermal measurements."

"Program 9: Is to be dropped as a program except for possibly 9.1, which we may want to carry."

(Ogle would be happier if they would not, would just note in the projects where EC&G is concerned that they are doing the technical photography.)

C. FURTHER DISCUSSION OF PROJECTS - Personnel, Requirements, Shot Participation, etc.

Table 1 summarizes this portion of the discussion. The following comments will supplement the information contained therein.

Comments on the Table

- 1.1a) Have no structures but must be tied in with the photo stations  
1.1b) (EC&G's stations).

Between-shot problems: they have to set up rocket launchers between shots, but presumably this could be done within a week. EC&G will have to move their cameras, etc.

- 1.1c Again, must be tied in with camera stations.

Aronson wants to be sure there is tree clearance along the line of sight of the cameras, so as not to duplicate the King Shot situation.

- 1.2 As it stands now, it is 3 agencies, ORI, HRL, Sandia Corp. There is a great deal of discussion about the number of people involved.

The interest here is in pressures up to 200 psi, higher pressures than they got on Ivy.

Ogle: either you tackle this from the point of view of getting your major data out of aerial photography, or you don't. If you do, then 1.2 should not need very many stations. If you don't trust photography, then why not say so?

Much talk about structures. If they cannot use existing structures on Eniwetok, Scoville says they probably won't be on there. There are no existing shelters near where will be shot. Campbell cannot build a Sandia-type station on the reef. Elunda suggests seeing what can be done at Eniwetok that will not run to terrific expense—they do not think large expenditures for shelters are warranted. The plan for Bikini is about 3 instrument shelters. They think it will probably be wiser to stay off unless self-recording instruments can be used. Campbell says even self-recording instruments, if they require bases, can be quite expensive. Elunda does not think

TABLE OF PRELIMINARY REQUIREMENTS FOR TU-13 (DOD PROJECTS)  
OPERATION CASTLE

Project	1.1a 1.1b	1.1c	1.2	1.3	1.4	1.5
No. of People	5	3 max	15	?	5	15
Shot Participation	2, 3, 4, 5, 6?	3, 4, 5	1?, 2, 3, 4, 5		2, 3 or 2, 4	4, 5
Structures required	N	N	4 (600's)		Share with 1.2	Relay stn Recording stn
Wiring (Timing)	Y Possibly Radio		Y Possibly Radio		Share with 1.2	Y Possibly Radio
Where Housed	Ship	Ship	Ship		Ship	Parry and Ship
Who	NOL Aronson	NOL Aronson	AFSWP Kingsley		Sandia Cox	ONR Thaler
Between-Shot Problems (unusual)	N	N	N		N	N
Lab Space	Ammo stge on ship / tent on shore / small lab space on ship (~10x12)		20 x 30 (ship?)		Share with 1.2	20 x 10 on Parry / steward space outside
Office Space	10 x 10		N	✓	Share with 1.2	

N = none or no

Y = yes

**TABLE OF PRELIMINARY REQUIREMENTS FOR TU-13 (DOD PROJECTS)  
OPERATION CASTLE**

Project	1.6	1.7	1.8	2.1	2.2	2.3
No. of People	N	5	5	3	10	3
Shot Participation		3, 4, 5	2	2, 3, 4, 5	2, 3, 4, 5	3, 4, 5, 1?
Structures required		Camera Stns	Share with 1.2	N	12 Concrete-lined holes	N
Wiring (Timing)		Y Possibly Radio	Y Radio	N	N	N
Where Housed		Ship	Eninman and Ship	Ship	Ship	Ship
Who		Scripps? Revalle?	AFSWP Kingsley	ESL	ESL	NRL Hanscome
Between-Shot Problems (unusual)		N	N	N	N	N Courier Flight
Lab Space		N	Share With 1.2	N	15 x 20	N
Office Space	✓	10 x 10	Share With 1.2	10 x 10	N	10 x 10

N = none or no  
Y = yes

**TABLE OF PRELIMINARY REQUIREMENTS FOR TU-13 (DOD PROJECTS)  
OPERATION CASTLE**

Project	2.4	2.5	2.6	2.7	3.1	3.2
No. of People	1	30	N	N	7	3
Shot Participation	3, 4, 5	2, 3, 4, 5			2	1, 2, 3, 4, 6
Structures Required	N	N			6 x 12x6 plus recording shelter	N
Wiring (Timing)	N	N			Y Radio	N
Where Housed	Ship	Eninman and Ship			Eninman	Parry and Ship
Who	CRL	NRDL CRL			AFSWP Kingaley	NEL7
Between-Shot Problems (unusual)	N	Recovery and repositioning			N	Entry time
Lab Space	N	20 x 20			10 x 15	N
Office Space	N	N	↓	↓	N	10 x 10

N = none or no  
Y = yes

TABLE OF PRELIMINARY REQUIREMENTS FOR TU-13 (DOD PROJECTS)  
OPERATION CASTLE

Project	4.1 ?	6.1	6.2	6.3 ?	6.4	7.1 7.2 7.3
No. of People	6	6	6	5	50 crew 25 exptl 75 total	5
Shot Participation	1 ?	All	All?	All	3, 4, 5	↑
Structures Required	Y ?	N	N	Antenna instal.	APD	
Wiring (Timing)	N	N	N	Y Radio	N	
Where Housed	Parry ?	Eniwetok Island	Eniwetok Island	Parry	Ship	Eniwetok Island
Who	AMCGS Brennan?	WADC	WADC	ESL Kerttulo	NRDL	
Between-Shot Problems (unusual)	Mouse Storage	N	N	N	N	
Lab Space	10 x 10	10 x 20	10 x 20	10 x 20	N	
Office Space	10 x 10	N	N	N	N	Y

N = none or no

Y = yes



TABLE OF PRELIMINARY REQUIREMENTS FOR TU-13 (DOD PROJECTS)  
OPERATION CASTLE

Project	7.4	Prog 8	Prog 9			
No. of People	N	A E C	A E C			
Shot Partici- pation		A E C	A E C			
Structures Required		\$30,000 cash	Cash Support			
Wiring (Timing)		A E C	A E C			
Where Housed						
Who						
Between- Shot Problems (unusual)						
Lab Space						
Office Space						

N = none or no  
Y = yes

they should spend very much. The station Sandia used on Eberiru is not available to the DON, since it is being used as a Ganex station, its original purpose.

U N O  
Ogle asks about the 3 structures on Bikini--there are 3 shots, this would be one shelter each. He is afraid they will not cover the range they want with 1 structure, unless they plan to cover it also with aerial photography or self-recording gages. He is trying to emphasize the range of distances involved here. (Campbell adds, "we instrumented to 23 miles on Ivy, and cried because we ran out of land".)

Scoville says they are primarily interested in the pressure region from 20 to say 2 or 3 psi. Ogle says the atmospheric effects (discussed earlier) will not show up in this region.

Campbell suggests that 3 structures be built for maximum pressures.

Conclusion: Assume 3 structures somewhere. Blunda adds, "put down 3 to 4 structures; we might want one on Bikini Island too". (Kingsley puts down 4. The (600's) denotes Sandia-type stations.)

Wire laying: LAST would rather have H&N do it, since in that way responsibility is clear. Some of the DOD agencies may want to do it themselves. Scoville thinks this must be checked with each project before an answer can be given.

Incidentally, cost on the 600-type stations is \$50,000 apiece if they are 20 miles away; if 1 to 2 miles, will run between \$200,000 - \$300,000.

General comment on timing signals: we have the radio equipment to do 3 times signals; the times have not yet been picked.

General comment on lab space, etc: discussion of where one does the major work, Eniwetok or Bikini. The assembly people are working on the principle of assembling at Parry for Bikini shots, but this will not apply to other groups because of transportation difficulties, etc. Cdr Hall is afraid one just cannot get the facilities desired (lab space, etc) on a ship. He emphasizes that the degree of military support we got for Bikini and Sandstone cannot be expected for this operation. Curry thinks we must recognize, however, that we cannot do all this from Bikini.

- 1.3 This project is questionable, and for purposes of the discussion today, we will assume that it does not exist. J-Division has their requirements from Ivy, and presumably they would be much the same for

this, if the project is done. Dr. Peoples promised us that if he did participate on Castle, he would get some self-recording instruments for a telemetering system which would not have to be manned. Hooper emphasized, however, that if canisters will be involved, we must know about it early. Scoville would say at the moment that it is not in.

- 1.4 Can this be the same people who do 1.2? (Cox also has 1.8) Campbell thinks this number (total for Candia) should be made approximately 30 if one scales the work from Ivy. Actually they will be doing more for this, because they will be on more shots. He would estimate 15, 10, and 5 people respectively for these 3 projects. Scoville and Blunda say this number is unreasonable. The matter of personnel numbers is argued for some time — it is finally decided to call it 5 people for this project.

Shots: 2 and 3, or 2 and 4 if the raft goes ashore.

Same structures, wiring, and lab space as for 1.2.

- 1.5 Thaler plans to do his assembly on Parry, would like the same space he had last time. He would estimate 3 weeks or a month on Parry before the shot. After that, will live on ship.

Thaler wants to have a telemetering system as a back-up in case of recovery problems. If he has a land relay station, then he will have a ship-based trailer. If he can get an aircraft, will do away with any relay and put the recording system in the a/c. He will take this up with the Task Force. He will have 2 racks in his recording structure, this includes everything.

(Ogle: we would prefer, if you have no objections, keeping the relay station on Enyu. Thaler says this is ok.)

If they can get the instrumentation help from Thaler (and Thaler says they can), NOL wants to obtain additional data, increase the scope of the recording, get more channels, to get a better coverage on the pressure-time aspect. NRL people will help Thaler in this project (for the above). They also would like to use, in this kind of a test, additional instrumentation of a different type than Thaler's. (They discuss how many extra people this takes — Thaler says it will be 2 or 3 and they are included in his original estimate of 10; Aronson says it should be more — they decide to make it 15.)

General comment on why the shot schedule is as it is: If, for some reason, the operation must be suspended before it is completed, the two least important shots are so they are at the end. Blunda asked if the shot had to be given up could one of the shots be the deep water shot? Ogle replied he thinks this could be arranged.

- 1.7 Scripps has promised to submit a proposal thru ONR on this problem. It should be forthcoming in a week or so.

This will involve photo towers (DGC) but Ogle doubts they can be the same ones as for other photography. It will be desired to observe floats, posts, etc., with reasonably good spatial resolution. One is therefore probably talking about small individual camera stations such as used for this coverage on Ivy.

More details must await the proposal from Scripps.

- 1.8 Will share structures, lab and office space with 1.2 and 1.4.

SUMMATION OF PROGRAM ONE: Number of personnel adds up to 53 — add a factor of 50% —

TOTAL: 75 people

- 2.1 We said yesterday we would do this on all but the Berkeley shots. However, Scoville is afraid one should not leave out shot 2 — because this is a surface shot, and one is not measuring just the prompt, but the total.

Scoville thinks film badges will have to be tied down better than last time. (Ogle says they stayed down fine last time, that was the trouble.) These will not be the dropping gadget type — they just want the total. Standard NBS badges will be employed.

Campbell inquired as to what intervals and what ranges would be covered. Scoville: these will be put down in an area pattern rather than radial, will just use the available land and anything in the water we can stick them on. Campbell asked if one would want special things erected in the water; the reply was, not unless there is a great big hole. Ogle thought there will be — all over. Scoville did not think so, if an area pattern is desired.

Lab space: Scoville did not think this would be needed, if they are not going to develop the film badges. Calibration: can use one of Gardner's dark rooms, Ogle thinks. Someone mentions RadSafe facilities; Hooper says Servis will be loaded already.

Recovery: Scoville says one recovers them as quickly as possible, when the RadSafe situation is ok. Hooper says fine, but this should be understood by the guy who is doing the experiment. The basic policy is you are not going to get in very early to recover.

- 2.2 The basic instrumentation is scintillation counters with recording instruments. Scoville says they are talking only of something like 12 channels, 12 stations, thinks they record with magnetic tape. This is long-time work like Berkeley did on Ivy.

What about coverage in distance? Scoville: there will be a maximum of 12 stations — not other atolls, but places in the atoll. This is to look at fall-out. No good reason to be awfully close.

Structures: concrete boxes, require holes in the ground but will not be very close — therefore, not very complicated. OK, 12 concrete-lined holes. Maybe not as many as 12, they will have 2 of these on the Liberty ships.

First estimate was 12 people, but Ogle points out that Berkeley did this on Ivy with 2 people for stations on the shot atoll, 2 people for off-atoll instrumentation. He suggests Scoville look into their system. Two people handled 15 gadgets spread on several islands.

Scoville thinks they will record for at least 12 hours. Ogle mentions we may well have the circumstance of appreciable activity at some of the islands from a previous shot, will want to turn the instrument on appreciably before the shot in order to get a recording of the background.

- 2.3 Someone should know of the problem here of shipping these neutron samples back to the States.
- 2.4 This may be out completely. Apparently, they will share facilities with 2.2, if done.
- 2.5 This is a big program. Discussion ensues about whether to do anything on Eniwetok or not. Scoville thinks not because it increases the logistic effort so much. Ogle points out [ ] is the biggest and also the most likely to go off. They might instrument the land stations (which Heidt told Campbell they could use again) at Eniwetok. But they want to concentrate on water stations.

These are stations which are put out and let drift, outside the lagoon. It will take a great deal of Task Force support. They go out to 50 miles and they are talking of a total of 50 stations (including all stations), so maybe 30 floating stations. Ten apiece, weighing about 1000 lbs, and probably have to be put out a day before the shot. (No, Scoville reads his piece of paper, and says they are talking about 80 free-floating stations — this was an old proposal and he thinks the number can probably be cut down after they know of the Bikini situation.)

Scoville thinks these will be weighted to the west. A 100-mile diameter to work in 24 hours before the shot.

This is NRDL, with CRL putting some additional collectors in the land stations.

Between-shot problems are major — recovery and putting them out again. It appears it will require 2 or 3 ships just to do this job.

2.6 Is all off-site lab studies of samples from 2.5.

2.7 Is out.

SUMMATION OF PROGRAM TWO: 47 — (round off) — TOTAL - 50.

3.2 To be done by DOD. Photography by Lookout Mountain.

SUMMATION OF PROGRAM THREE: 10 TOTAL - 10

4.1 This is a question-marked program, but they will put some numbers down for it.

Ogle: we would like to know as soon as you do know, what you propose doing with the mice before they are positioned; if it takes another island, we should know about it.

Shot participation is questionable. Ogle: from the point of view of getting a neutron spectrum — if you're on the [ ] you'll get primarily a fission spectrum. [ ] are best from the point of view of the experiment, but they do not want to have mice on barges, so [ ] is questionable — also on [ ] they would be working on the reef. (They put down [ ] with a question mark. Also on 2.3, since there were neutron measurements involved there.)

They will need to shield pretty well or will lose the mice. Scoville doesn't think it is worth doing the experiment if the effects are just within 2000 yards. This does not rate a big structure. Ogle doesn't think you can keep a mouse alive there without quite a structure, even at 2500 to 3000 yards.

SUMMATION OF PROGRAM FOUR: 6 TOTAL - 6

No comments on 6.1, 6.2, — see table.

6.3 Again, is a question-marked program, but some numbers were put down.

6.4 This is the Liberty ship deal. Personnel estimate: total of 75 for crew and experimental personnel.

LASL again suggests they should bring along a third ship as part of their package deal — for control, and also to house these 75 people. Something like an APD.

SUMMATION OF PROGRAM SIX: 92 TOTAL - 100

7.1, 7.2, and 7.3 are off-site AFOAT proposals.

7.4 is combined with Spence's program.

Hopper thinks it will be similar to Ivy in terms of number of people (AFDM participation) — there were 31 total Program 7 people on Ivy, most of these on Kwajalein. Some of these will still be on Kwaj, for long-range samples. Put down 5 for Eniwetok Island.

SUMMATION OF PROGRAM SEVEN: 5 (Call it 4 because it is easier to add)

TOTAL - 4

Program 8 - The DOD is not doing 8.1 (Stewart is doing this under LASL's program) but may support it financially. How much? Ogle would guess something like \$30,000. Kingsley puts this under "structures requirements".

The report on this project will be included as part of Stewart's regular report.

Program 9: This probably has a similar "structures" number on it, which Ogle would hesitate at the moment to guess at. Kingsley writes "AEC" all thru column, with "Cash Support" in Structures column.

Total number of people in  
DOD programs: (using adjusted numbers)

Program 1	75
Program 2	50
Program 3	10
Program 4	6
Program 6	100
Program 7	4
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TOTAL	245 nominal