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I/1991

Summary of Notes on Meetings
Held In
J Division
Los Alamos Scientific Laboratory(U)

2 and 3 April 1953

OPERATION CASTLE PLANNING

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JTF-7:	J. L. Hall
NRL:	W. N. Fitzpatrick J. P. Walsh
ONR:	W. J. Thaler
Scripps:	J. D. Isaacs R. Revelle
SFO:	James E. Reeves (second day only)
TG 7.5:	P. W. Spain (second day only)
TU-13:	H. K. Gilbert N. E. Kingsley W. McLellon

[redacted]

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I. REVISED SCHEDULE

The present Castle Schedule is as follows:

1.	DELETED	Bikini: Surface Shot (on Barge) over deep water— off Bokororyuru
2.		Bikini: Vicinity of Namu
3.		Bikini: Barge, Vicinity of Yurochi
4.	DELETED	Bikini: Barge, Vicinity of Yurochi
5.		Bikini: Eninman
6.		Eniwetok: Eberiru

II. DOD PROGRAMS - Discussion Conducted by Kingsley

TU-13 Hq has requested information from all their agencies as to details and requirements of the projects. Kingsley described the results of their inquiries to date.

PROGRAM 1 - BLAST AND SHOCK MEASUREMENTS

1.1 Blast Measurements by Photography - NOL

a. Free Air Pressure (Rocket Trails)

b. Precursor Phenomena (Rocket Trails)

It is desired to have these projects on all shots. No information has yet been received from Aronson as to location of his rocket launchers.

Present plans for EG&G photo tower locations are as follows: For Bikini: 75-ft towers on Namu, Eninman, and Bikini, a 300-ft tower on Enyu, and a concrete pedestal 10 or 12 ft high on Yurochi. For Eniwetok: a 75-ft tower on Muzin or Kirinian, a 125-ft tower on Parry. Aronson is aware of these camera locations and is presumably making his plans on this basis.

Inclusion of this project on all shots was questioned. For example, to have the bomb between rockets and camera on the deep water shot would necessitate that the launchers be out on rafts in the water, which sounds impractical. Kingsley replied this question must await details from Aronson. Possibly the project cannot be done on all shots.

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that it also might be covered by the other aerial photography.

1.2 Pressure vs Time on the Surface

In general, this project has been split between Sandia and BRL, with the former to use their regular instrumentation, BRL to try to develop the self-recording gauge which they are prooftesting at Upshot-Knothole for use in the higher pressure regions.

a. Pressures less than 40 psi - SANDIA CORP

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(Incidentally, except for this project and the film badge measurements, all DOD instrumentation will be on Bikini.)

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Kingsley stated this is a new factor to them and locations may have to be reconsidered. DELETED DELETED However, they are interested in a fission weapon, for operational applications.

Sandia's plans, subject to modification in view of the foregoing statments, are as follows. For the last shot, they would have 11 to 14 measurement positions along the Aomon - Rojoa string in the pressure region ranging from 4.5 to 100 psi, which goes up considerably into the self-recording gauge range (see 1.2b, below). For recording, they can use Bldg 56, 802 or 803, all on Biijiri; if they cannot have access to one of those, would want a building on Rojoa.

Also for this shot they want q (wind velocity, wind pressure, $1/2 \rho v^2$) measurements at 30 or 40 psi, which will take six channels, and G (acceleration) measurements at 70 and 100 psi, with measurements in three components of acceleration at both those pressure ranges.

DELETED DELETED DELETED This is the end of the airstrip, but the shelter can be put off to one side, any place it is convenient to build it.

Ogle mentioned the jet which will come down the vacuum tube on this shot, dead into their array; this may not actually foul them up at all but they should consider other positions if possible. Campbell informed them of this yesterday, but there are not land masses at the distances they want on the other side of Eninman. If they abandon the Ramrod shot they will probably want to move in closer on this one because they wish to get ~ 100 psi on their instruments. This they could do on Eniirikku but it means clearing more of the island, and there go the trees which are desired for Project 3.3.

For this shot, they plan to have q measurements in the 40, 30, and 20 psi regions (two stations on Bigiren, one on Peter, Jr.), and G measurements, again in three components, at 200, 100 and 40 psi (two on Reere, one on Bigiren).

For the lagoon barge shots they propose three measurements on Romurikku and three on Aomoen, each island of which will require a shelter because of fear of disrupting the cable by running it across the reef. (They experienced a great deal of trouble with this on King Shot.) These stations will also be instrumented for the Hunt shot, should get pressures ~ 2 or 3 psi. No q or G measurements will be included in these stations.

[redacted]

pressures on the Ramrod as was raised above for Sandia: the fact that this is not a typical situation blastwise.

1.3 Shock Winds and Afterwinds - SANDIA

Covered above in discussion of Q measurements.

1.4 Underwater Pressure vs Time - ONR, NOL

Thaler described the details of these measurements. Present plans for participation are in Shots 1 and 3, and on the basis of discussions with Campbell this morning as to where Shot 4 may be located, it appears they may be able to get some additional data on this shot with practically no extra effort.

This project has requested that the weapons barge for the first shot be located ~ 1-3/4 miles off Bokororyuru, where the water is 4000 ft deep. (The reasons for this location are explained in Section III.) Since the firing of the Zombie is problematical and a Runt may instead be fired for this shot, they have had to prepare for both eventualities, and have worked out the following arrangement for positioning their gauges.

The main concern here is recovery of the cans. They have talked with Professor Arons and other experts in the field of underwater pressures and were told that base surge criteria and water column height from a burst such as this can be scaled as a function of the cube root of the charge yield.

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On the other hand, if it goes small, the pressure level at the gauges will be decreased but as long as their gauges have enough range to cover the pressures expected from the lowest to the highest they will still get results. These gauges are linear from 0 to 3000 psi.

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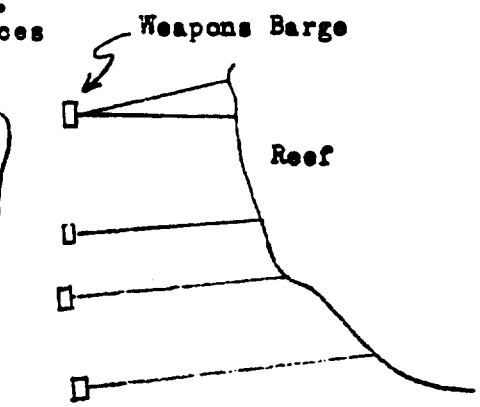
(Ogle had mentioned in discussion of another project the large range of yields which must be planned for. DELETED DELETED The instrumentation must be planned with enough range to go from 100 KT to 4 MT.)

Getting pressures at distances of interest to submarines is achieved by putting the gauges at different depths, since the pressures increase with depth of water.

The instrument lines will be in a position roughly as shown in the sketch relative to the weapons barge. Three lines will be used, to achieve distances of 6730 or 7500 ft (depending on the weapon chosen). 10,000 and 16,000 ft from zero.



DELETED DELETED The moorings planned will position these to several hundred feet.

It is thought that a 1-1/2" chain should be sufficient to go from the moorings to the water. Then a 1/2" wire cable with breaking strength of 28,000 lbs will be adequate from the cable to the buoys. A deep sea moor will be put down to a 2800 lb anchor with a 1-1/2" chain leader. The instrument cans will be fastened to this system.

It is planned to use a net layer and a tug, the former to lay the moors, the latter the cans.

As for the pressures expected, there are practically no data available on large-scale surface bursts, so they have taken small-scale data and attempted to scale it up. This has resulted in the predictions noted below for instrumentation at depths of 75, 250, 500 and 1000 ft, as shown in the sketch.

All instruments are self-recording on magnetic tape within the buoys. In addition, it is planned to telemeter the information from the 8-channel Wiancko system at 10,000 ft. They had considered telemetering by a remote-controlled relay station on Eniwetok to a manned aircraft which would have a recording station in it. (Photographic recording would be used for this phase.) The aircraft also has a command

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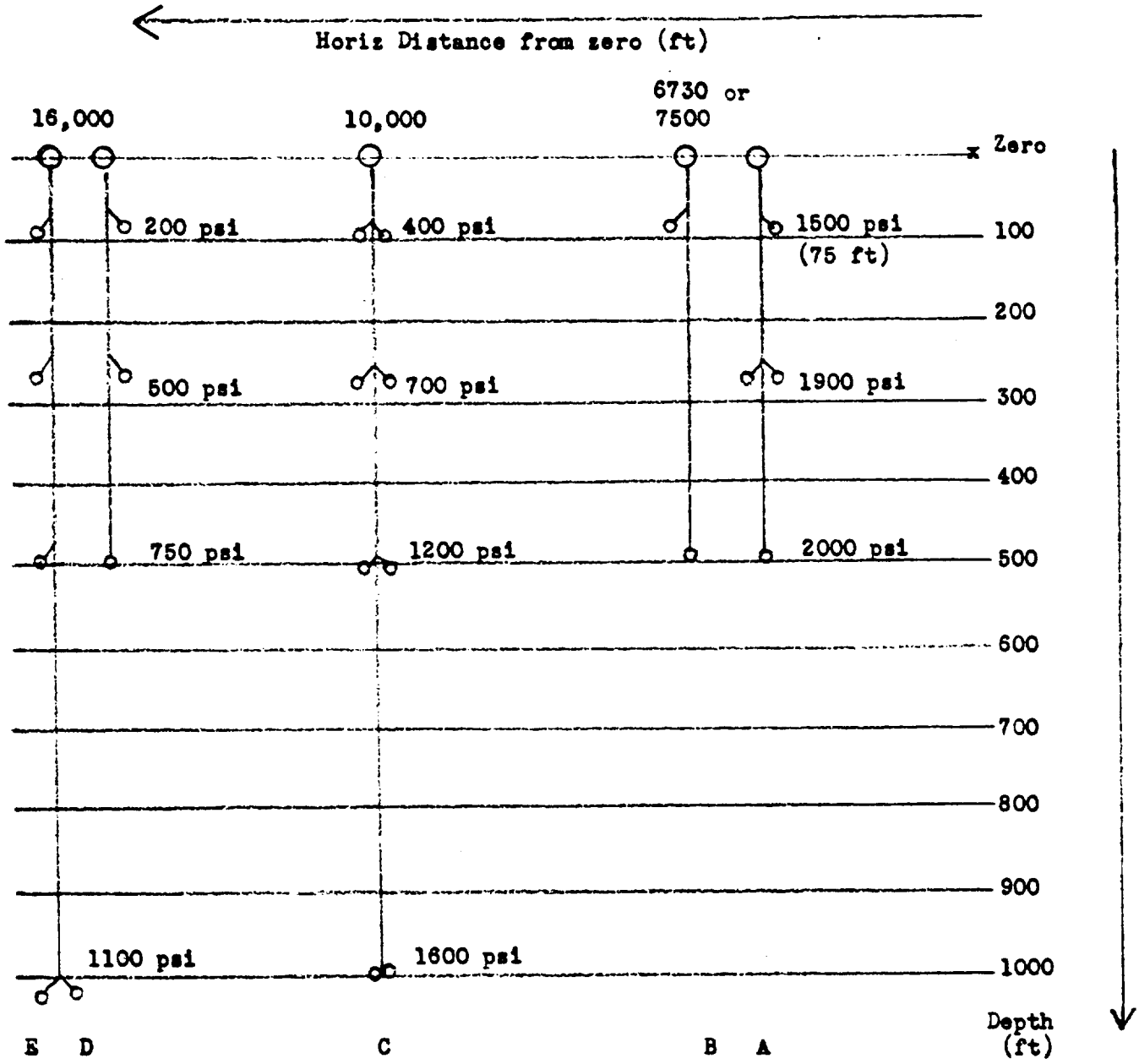

Instrument Line "A" is a 4-channel NOL system; "B", a Hastings system; "C" is an 8-channel Wiancko system.

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time, came back on a second or so later.) They will check into this. If it appears serious they may telemeter the more distant line rather than the second one.

For the third shot they plan three lines in the lagoon. The first one will go from a little less than 1/2 mile from zero out to a little more than 1-1/2 miles. For the close-in measurements mechanical ball crusher type gauges will be used. The second line will go from 1-1/2 to 2-1/2 miles, to which is attached the first set of recording cans. The third line will be the same as the second.

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The ball crusher gauges go underwater. They are planning 64 gauges per station in piles of four, every 10 ft to the bottom; there will be 11 ball crusher stations along the line, which makes something of the order of 700 ball crusher gauges in the lagoon.

In addition to the instrumentation mentioned above, there will be an NOL four-channel station positioned so that gauges are at 125 and 75 ft depths of water. The Navy is interested in pressures on a sloped bottom.

It is thought that free information can be obtained from the fourth shot by leaving the cans in after the third. One of the things they will get for certain, assuming everything is working properly, is the telemetered information. If there is sufficient time interval between shots they may be able to go in and spot three or four cans, lift them out, change the tapes, and put them back. They will do this if they can and with as many cans as they can, depending on the next shot time.

They are planning to have all the equipment assembled at NRL by 1 July and then take it out, can by can, to their underwater testing and explosion site in Chesapeake Bay and test them with shaped charges, scaling up the results. From 1 October to 1 November they plan to have a complete checkout of everything, then button up and send it overseas. Paul Walsh will be head of this project in the Forward Area.

Thaler next discussed their logistic problems, which are considerable. Estimated number of people is: NRL - 10, NOL - 20, DTMB - 4. The groups will be broken up as follows:

1) Electronics: they hope to have working space on Parry, an open shed with a roof on it, will work on roughly 20 buoys, lifting them around with a fork lift and crane. They have also requested dehumidified laboratory space and a little office space.

2) Mooring: they have asked for 40,000 ft of open storage area on Eninman, and will have the net layer standing by, will also need an M boat, crane and fork lift at Eninman. It is hoped to have the moors in by 1 February, and then they plan to immediately begin putting out the cans, so a few of them will be in the ocean two weeks.

3) Telemetering: the third group will be working on installation of equipment in the relay station. About three people are involved.

One of the big problems, aside from mooring the cans, is transporting everything from Parry to Bikini. This should be done about the first week in February, they will perhaps use an LST and a tug.

[redacted]

as much information as possible on wave velocity and amplitude, both in deep sea and on the beach.

Revelle and Isaacs outlined Scripps' thinking to date on how these measurements might be performed. One way which is promising, judging from the measurements they made at Crossroads where there were quite large waves, is the photographic method. This would involve essentially automatic-cycling aerial cameras on towers at sufficient height so they can see across the lagoon if possible or at least a good way into the lagoon.

The phototower locations, as described in the discussion of Project 1.1, above, were examined with regard to the performance of this measurement. It was agreed that all barge shots except the first one can be adequately covered by existing towers. Scripps would want to have cameras in those at Bikini, Enyu, and Eninman. The Zombie shot, however, presents difficulties, since it is desired to get two lines on each object with a reasonable angle. Aariikan was discussed, since there will

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[redacted] distant recorders at Kwajalein, Wake, etc. They are thinking of from 8 to 15 pressure and water level recorders, to be placed on Kwajalein, Eniwetok, Guam, Wake, Eninman, Chieerete, and Bikini. These will be self-contained units but have a cable from transducer to recorder, must be anchored somehow, and require a recording station on shore. This latter is possibly about a 3-ft cube, a small, waterproof box containing a recorder and power supply. (Scripps are considering even a simpler unit than this, with a box the size of two cigar boxes). Ogle suggested that if it is that small it would be simpler for Scripps to furnish their own steel-welded boxes, rather than go through the rigmarole with H&N. The boxes can probably be fastened with anchor bolts into the coral rock.

Revelle stated he thought Scripps was prepared to put 6 - 10 people out there at the time of the shots; this would include Bikini and surrounding islands. He estimated costs as follows:

Personnel	$15,000
Overhead	5,000
Instruments	20,000

One requirement is that Scripps have a small boat essentially under their control for the whole period (extent of this period is not certain, perhaps

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a month), an LCM or something of that nature, to place the instruments.

Scripps will submit a proposal to ONR covering the work discussed above. In addition, they will suggest that the drone ships of Project 6.4 be instrumented to augment this measurement.

1.7 Close-in Ground Acceleration - SANDIA

Covered above in connection with 1.2a.

PROGRAM 2 - NUCLEAR EFFECTS

2.1 Gamma Film Dosage Measurements - ESL

This is planned for all shots, including the one at Eniwetok, with 200 to 500 badges out per shot. No shore construction is requested (the impression is that ESL will provide the stakes and pound them in themselves); but they do have a requirement for an accurate survey, film storage, and space for a motorized van (a mobile laboratory, one of the Signal Corps labs similar to what they had on the Rendova). They want this at Bikini for the Bikini shots and at Eniwetok for the last one.

Ogle would worry about taking off a trailer to a ship for each shot and then bringing it back if there is much contamination (and he thinks there will be), particularly if this is a film trailer. Servis stated that the RadSafe people could handle the processing, and that so far as film badge processing is concerned there is no reason for anyone else to request these facilities. (Projects 2.3 and 2.5 have also requested trailers for this purpose.) It is hoped that these requirements can be consolidated.

Kingsley thought that what ESL means by an "accurate survey" is the accurate location of structures nearby, so they can pace off distances and know where their film badges are. These badges will be scattered all over the land areas to measure total gamma dosage, presumably including whatever fall-out falls on them. Information on just how and where ESL will want to put these should come in this week.

2.2 Gamma Dose Rate vs Time - ESL

Planned for all Bikini shots. This project will involve 12 to 24 scintillation counters (total for 5 shots) placed in 55-gallon drums with concrete caps, 2-1/2" ID pipe for the probe, concrete bases needed for the drums. Timing signals are also required. Information on desired locations is not yet available.

[redacted]

2.3 Neutron Flux and Spectrum Measurements - NRL

NRDL had originally planned some participation here, but will now not be involved in the project and this is only NRL (T. Hanscome). There are some construction requirements, piling with concrete caps, details not yet known.

2.4 Neutron and Gamma Ray Shielding - CRL

This project has been cancelled.

2.5 Fall-out Distribution Studies - NRDL, CRL

This is another project which poses a large operational problem. It involves putting out 100 stations radially at 18° intervals with distances of 5, 10, 20, 35, and 50 miles. Of those, 20 to 30 will be on land or anchored on rafts in the lagoon. The others will be free-floating outside the lagoon. The rafts will be the same type (DAN buoys) as used for Ivy; they are 2 ft in diameter, 3 ft high, float almost submerged and have an antenna. CINCPAC has made a requirement that they have positive identification on them this time, so they will not be confused with submarines.

Two vessels will be needed, capable of covering 12 knots, to place and recover the rafts for Shots 2, 3, and 5, from D - 2 to D + 4. They would like to have the vessels based at Eniwetok, which will mean an additional time requirement. On the recovery phase (to D + 4) they also need occasional use of a spotting aircraft. The Task Force (Hall) has their requirements, knows they are in addition to our previous requirements, and is starting action on them.

The land-station portion of the project is designated as 2.5b. Land stations will be located near the Project 2.2 stations (the scintillation counters). Ogle questioned this: the 2.2 stations are supposedly within the range of prompt gammas, and he would expect these to be outside that range. That is, he would expect the DOD not to be particularly concerned with fall-out in the first mile and a half but to be more concerned with it from there out to about 50 miles, whereas one would want the γ (t) instrumentation in closer. Kingsley replied that there is enough overlap that some of the 2.2 station positions will be suitable, since for some of the shots part of the stations will be more than 5 miles from ground zero.

2.6 Radiochemical Analysis of Ground Contamination - NRDL, CRL

No construction requirements at the site.

[redacted]

PROGRAM 3 - STRUCTURES

3.1 Loading of Structures - SRI

To be done on Shot 5 only. It will involve one cubicle identical to the one being used on Frenchman Flat for U/K, a rectangular block of normal concrete, exterior dimensions 6 x 12 x 6.

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The structure would be placed with the front face normal to the blast. It must be held fairly rigid, they do not want it to tumble or move appreciably with the blast, since the object is to measure loading on a rigid structure. It will be at ground level, will require an underground base. (It was agreed that the prints for the Knothole Project 3.1 structure could be used for the aboveground portion.)

There will be about 40 channels of instrumentation on the structure, to measure pressure-time. A recording station will be required at some distance; Gilbert did not think it could be over 6000 ft from the cube because of cable length limitations. Doll is working up his requirements for the recording shelter, it is not thought it will have to be very big.

There is a possibility this may be tied in with Project 3.3; if there is instrumentation for the trees, it might use the same recording station. Kingsley is not sure they can do this. They wanted some pressure instrumentation among trees and there are none on these islands to the east of zero. The only trees are on the west end of Eniirikku.

It was suggested that this cubicle might also be put on Eniirikku. Campbell has to build some photo structures over there anyway, and if this means combining the recording on these two projects into one shelter, it would be an advantage.

DELETED DELETED Then, since the trees are in a lower pressure spot, the recording shelter will probably be put among the trees so as to have approximately equal cable lengths. The trees will have to be stripped up to the building, since they want a clean shock wave to hit the cube. (Ogle thought if they wanted that, they should put the cube on the shore.) Doll will furnish information on cable lengths and inside dimensions of the shelter. It is thought that film recording is proposed. This will pose a recovery problem because of fall-out.

L. M. Swift will be project officer for 3.1.

It is urged that for Shot 5 participation the instrumentation be in and ready to go, with the possible exception of very last-minute checking out, before Shot 3 and preferably before Shot 2, because there is a very good chance of fall-out from prior shots.

3.2 Crater Survey and Evaluation - SRI

The Army Map Service, with coordination by SRI, has agreed to prepare a plan for photography to be taken as soon as possible after each of the land shots for each crater. Ogle has discussed with Vaile at NPG the question of how soon after the shot this work can begin. He feels that as long as they use planes they can take a picture 1/2 to 1 hr after the shot, but discouraged him with all vehemence from trying to take profiles from a boat in less than something like two days after the shot.

NEL will put fathometers in an LCM and traverse the crater, will want to get in as soon as possible after the shot. They expect to be able to work out a plan to dump some buoys over the side and take sightings with a periscope if necessary. (Ogle said he did not think they should go in if it is that hot.)

It is planned that Lookout Mountain will do the photography. They will be approached next week on this point.

3.3 Pressures in a Tree Stand - SRI

A one-shot affair (Shot 5), probably to be done at the west end of Eniirikku, as noted above, involving 10 or 15 channels of instrumentation, measuring pressures on the ground. The Tree Service would like, if the pressures are right, to instrument the trees as well, but at the moment it appears the pressures are not proper in this one tree stand which is the only one. At any rate, the Tree Service may request a few more channels for tree instrumentation; this would be done for them by SRI.

Doll thinks 6 or 7 people will be enough for all this work, including the trees.

PROGRAM 4 - BIOMEDICAL

4.1 Neutron Dosimetry with Mice - Walter Reed

This project has been dropped.

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The ships are at Mare Island now, and the Task Force and Project people will take care of their being put into commission. If this can be treated as a test operation, the total number of people will be around 125. There has apparently been no ground gained in getting a control ship for this project. They want radio control for both steering and main engines (so as to control both speed and direction). They have a P2V for the control airplane and also want to plot the position of these ships from the Task Force command ship and give orders to the control aircraft from there. This was to be pursued further this week at another meeting with the Task Force. The latter was trying to avoid having people in the control room on the ship, wished to have them all in the control plane.

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[redacted] whether they must be ones we have already requested. We will have three. This job plus towing the helicopter barge commits these three; he does not know how many other requirements there will be. The DOD does have other requirements.

This project also wants 2 LCM's available, one to stand by the ships as a clothes-change station and shower room, the other one to operate a ferry service for the working party people. It was suggested they use a barge instead of an LCM.

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It is not yet known how close they will be. They want to get inside the cloud, but outside the blast damage range--this may be quite difficult. They are planning to be on the first shot, Shot 3 or 4, and 5.

Kingsley was sorry he could not report all these operational problems are solved, but the Task Force is working on it, and they did not indicate too much alarm.

Hooper expressed worry about the operational details, the plane control instead of a ship, the helicopters--we do not have enough of these as it is. He asked if they considered at all seriously the idea of ship control with another ship brought out expressly for this project, e.g., an APD. Those present did not know. (Hall came in later, said that the idea had not gotten very far.) Graves suggested controlling them from the tugs, making this a self-contained unit.

Hall is investigating all these things for the Task Force, Ogle thought we must get together with him and get a detailed plan for movement the last few days. He was also afraid they were right about having to bring the ships back to Eniwetok or leave them out in the ocean to decontaminate them. The Bikini Lagoon may be so hot from Shots 3 and 4 that its water could not be used to decontaminate the ships. The DOD and Task Force did not want to commit the tugs for too long a time, therefore would prefer to leave them at Bikini.

6.5 Decontamination and Protections - CRL

This consists of some participation in 6.4 aboard ship. Kingsley did not know the exact nature, but thought it was the usual thing they do. No shore construction is required. 6.5 was not in the list we had at the last meeting, however, even at that time it was to be a joint project, at least CRL was to have some participation in 6.4. Kingsley thought possibly it could all be put into one project.

PROGRAM 7 - LONG RANGE DETECTION - AFOAT

7.1 EM Radiation Calibration

7.2 Detection of Airborne Low-frequency Sound from Atomic Explosions

7.3 Seismic Measurements

7.4 Calibration Analysis of A-bomb Debris

No shore construction requirements at the site have been submitted for any of these projects. The last word Kingsley had was that 7.1, 7.2,

and 7.3 would be based on Eniwetok Island. Should the Air Task Group be moved to Kwajalein, these projects might move also. 7.4 would probably also follow the planes, since it is connected with collection of air samples. Part of this is also allied with LASL's radiochemical collection; Spence has an agreement with AFOAT to give them part of the filter paper.

Program 7 includes essentially all the projects AFOAT-1 has done in the past with the exception of the one concerned with detection of fireball light at distances. It would appear, therefore, that they will have requirements on Parry or Eniwetok. Kingsley has no word yet as to what these are. Campbell thought they would probably include things like antennas and poles, communications, a small lab, etc.

Incidentally, 7.4 has indicated they will want 10 people at Eniwetok (we had previously figured 5 forward). Again, these people would probably wish to stay with the Air Task Group.

PROGRAM 8 - THERMAL MEASUREMENTS

We had not originally planned to make thermal measurements on all six bombs, only the LASL ones. Ogle thought this would probably not quite fill the DOD hopes, since some of their instrumentation will be on the Morgenstern. Kingsley said yes, they would want total thermal on that bomb. DELETED DELETED Kingsley thought it would be quite acceptable to the DOD not to have measurements on Ramrod, but he would like to verify this and let us know.

To make sure we are talking about the same thing in connection with this program, Ogle explained that most of Stewart's thermal stations will in general be several miles from zero, as on Mike. At the moment there is no proposal to make any measurements from the air; most of the instrumentation will be in EG&G's photo towers. Quite often, information obtained from close stations will disagree with the more distant measurements, largely because of dust problems.

Kingsley will talk to Seoville and Giller about this to make sure it is satisfactory.

PROGRAM 9 - SUPPORTING MEASUREMENTS

No program except for accounting. Photography by EG&G and LCML, timing by EG&G, and meteorology by JTF 7 will be parts of the requiring projects.

photography, in connection with 9.1 work. Ogle wondered whether this is different from what EG&G has already been requested to do: they will take cloud photographs from the various towers on Bikini and Eniwetok and in addition from a plane or so which we are arranging for, in particular, from Plank's plane which will be at about 35000 - 40000 ft.

Kingsley explained that the genesis of their request is a difference of opinion as to where the bottom and top of the cloud were on Mike. Maynard talked to Fussell about this at NPG and Fussell indicated they would like to submit a proposal on it.

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III. POSITIONING OF WEAPONS BARGE FOR SURFACE SHOT OVER DEEP WATER - W. Thaler, et al

The plans for placing and mooring the weapons barge as presented by Thaler, Walsh and Fitzpatrick are illustrated in Figs. 1 and 2. Further description of the proposal and comments made by the group are noted below.

Because of the information desired on underwater pressures, the first question considered in working out this proposal was how far from the reef the barge should be positioned in order to get away from reflections of the pressure wave off the reef. That is, they wanted to make sure the arrival time from the bottom refracted ray would not distort the apparent shock wave.

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Refraction worries do not enter for the first two stations, but for the third it turns out that (assuming a clean pressure shock wave from the water), if the barge is positioned in 4000-ft-deep water, the bottom refracted wave should arrive 15 msec after the arrival of the initial shock pulse. On this basis they looked at the submarine geology of the southwestern portion of Bikini, again using Crossroads data for the profile of the reef, and the point at which the water is 4000 ft deep is 1-1/2 - 1-3/4 miles offshore.

In the mooring considerations, the barge was assumed to be equivalent to a 500-ton YC. Ogle stated this is correct on the assumption that we do not have to worry about getting it anchored and then having appreciable weather. The subject calculations have safety factors of 5 to 7 and Thaler felt they could take care of a 1000-ton barge without any strain, should it be that large.

For the stringing out of the shore cable, a calculation was made to see how many flotation buoys would be needed to support it over the surface. A 40-float array was first considered, with a span of 200 ft between floats, considering the tension required to maintain 20-ft sag in the catenary. As noted in Fig. 1, 1-1/4" diameter wire rope will be used, with a breaking strength of 108,000 lbs. They then decided a lesser number of floats would be adequate, went to 20. The total tension required to maintain this catenary all along is 8315 lbs.

The Wigwam people have considered mooring problems and they find that for a 15-knot average wind speed the force exerted on a bare barge is 800 lbs. Thaler did not know how large the weapon cab will be so had not calculated the additional force but stated it is a simple

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this apparently from Crossroads data.)

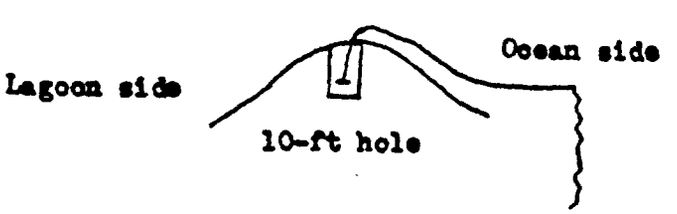
They intend to put deep sea anchors out at 45° to the reef. Ladd's Crossroads data indicate that during the periods of flood tide, which run for a period of 5.2 hrs every day, there is a 1-knot surface current flowing into these passes toward the lagoon.

ONR has talked to net layer people about the problem of deep sea mooring, and they saw no problem in doing this in 4000-ft-deep water. (Thaler's project put down moors in 3000 ft of water during Ivy; of course they were much smaller so far as size of cable was concerned, etc.)

A calculation was then made of the horizontal tension necessary to stretch the line, allowing 4400 ft of cable which gives a 1.1:1 ratio of cable to water depth. This is again 1-1/4" diameter wire rope, weighing 2-1/2 lbs/ft. It turns out that a force of 5000 lbs is required to straighten the mooring line out, before any lifting on it is started.

There seems to be a difference of opinion as to the condition of the old moors. A teletype from overseas said the chains were rusted and the moorings were gone. Thaler did not think this latter could be true; he explained how they were put in for Bikini, thought perhaps just the chains will have to be replaced.

The deadman construction is something as shown in the sketch.



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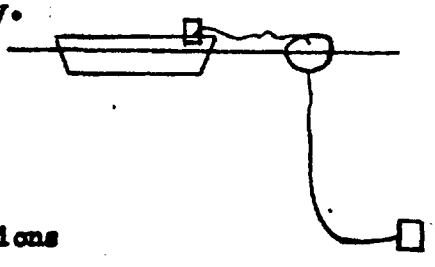
because they are afraid of chafing on the reef. This would probably be 1-1/2" chain. They would reactivate the deadman, run the chain out as far as one has to, hook the cable on, then begin paying out the mooring line and attaching the flotation buoys as they go.

Ogle expressed worry about tension on the line. Thaler hopes to get more information on the size of barge and weapon cab and the configuration, then calculate the forces with various wind velocities. This is not the final proposal he is presenting now--it just indicates the general direction and how they will calculate it when they get final numbers on size of barge, etc.

For the last 100 ft or so, the net laying people suggested 1-1/2" chain again be used because when the catenary is not tight it lies flat against the bottom. They would then hook into the clump and from there would be another chain going out to the anchor. Kingsley suggested that the longer this chain, the better off one would be in safety. They have not yet decided on the length of anchor chain. It is a sand bottom, so presumably the anchor will bite in all right and the clump should dig itself in also.

Ogle raised the question of the line being so close to vertical that if there is very much motion there is a serious chance of dragging the anchor. Kingsley suggested a scheme as in the sketch, said one could bring the deep sea moor up to a buoy. Spain thought the buoy would have to be sized so it is submerged and could not be lifted. Ogle felt the sea anchor part should be designed for the case of appreciable wind in the wrong direction. Thaler agreed completely, said they had no intentions of relying on wind predictions. He, and the people he talked to, felt they had enough safety factors here unless there was a serious storm.



Hooper raised the point that the barge will presumably not be put out very long in advance, will be unattended probably for not more than 12 hrs.

As for the possibility of a storm wrecking the buoys before the barge is placed, Thaler stated that the surface area which the wind

forces have to work upon is extremely small for the kind of buoys considered here. He can make some better calculations but thinks they will be safe.

Accuracy to which the barge can be positioned was discussed in some detail. The maximum variation which LASL would like is 50 to 100 ft, because of the fast photography, the station for which will be on Arrilkan, essentially perpendicular to the anchor. (The cameras we would like to use have a 40-ft field of view; it is doubted the barge can be positioned that well. On the other hand, should we have to go to cameras with a 300-ft field of view the experiment will have much less value.) As Harver pointed out, the cameras can be positioned after the barge is in place, and one does not care how much motion the barge has in the line of the cameras themselves, it is motion toward and away from the shore which is critical. Thaler and Walsh thought the barge could be positioned fairly accurately, but have not as yet calculated this so have no firm numbers. Walsh said it could be regulated; in order to position the barge one hooks on to one of the telephone buoys that are fastened to the deep moor. The closer the barge is to the telephone buoy and the less the cable, the tighter the barge is positioned. He added that in positioning submarines in shallow water the Navy use what they call a stretched moor, i.e., all lines are tightened, and he thinks at the moment this will probably be necessary here. If one does not do this, he does not think it can be positioned to better than 200 ft.

Harver said H&N has looked into positioning in 180 ft of water, using the same principle. They used a line four times this depth, then 180 ft of chain to the anchor, so that the total length to the anchor was five times the depth of water. Their sinkers were lifted so as to stretch the line and very good positioning was obtained by this method.

Thaler will take the figure of 50 to 100 ft for accuracy of positioning and try to work out their calculations on that basis. (Ogle asked that they try to make it better if they can.)

There are two questions, then, which it is felt need further investigation: (1) How does one make sure the mooring does not get carried away, and (2) How accurately can the barge be positioned.

The discussion then turned to time scales and assignment of responsibility. It is LASL's feeling that since after all we could be in quite serious trouble from the point of view of the whole operation if this particular phase were to fail, we would like to see a test of it essentially just as soon as the barge can be put out there. This must wait until the moors can be fixed and appropriate vessels

can be put out there to do the work. It was suggested the tests should be run before construction of the photo blockhouse is started, since if it turned out the experiment cannot be done satisfactorily, the station would not be built. Spain estimated that it will take of the order of three months actual time at the site to get such a station built, this with all the material out there. It appears the test should be done, then, between July and September at the latest. For Thaler, this means getting a net layer and tug out there, and procuring the materials. Most of the material can be procured from the net tending depots in BuOrd; he has an off-the-cuff agreement that they can supply this, but it takes confirmation. As for cost, he thinks he can get it for nothing but is not sure. H&N already has a barge out at Bikini, with a man living on it.

During the rest of the discussion, the following items were listed for attention of the person or agency indicated:

1. Thaler: Restudy positioning barge (gusts to 45 knots).

2. Ogle: Restudy acceptable limit on position.

3. Curry: Place requirement on Task Force for placing barge in early summer.

4. H&N 7.5: Provide 500-ton barge when Navy ready to place it.

5. H&N 7.5: Study movements and behavior of barge when positioned. Record wind, estimate current, record orientation. Minimum of 2 wks - to include wind conditions comparable to shot time.

6. J-6: Provide Thaler with information on our cables.

7. H&N 7.5: Renovation of Deadmen.

8. H&N 7.5: Assist as requested in accomplishment of Item 3.

9. One extra barge may be required (DOD expense).

Item 1: It is felt that further calculations are necessary on the barge positioning, considering wind loading from gusts up to 45 knots. Thaler stated they can simulate the weapon cab on the barge, so as to calculate the loading forces on it. The barge must be held to a restriction as to rotation, should stay fixed with respect to the system. Ogle thought this restriction should be about 20 or 30°.

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[redacted] the chain must be fastened to the deadmen. Thaler said they would probably need about 500 ft of chain per deadman. It was agreed this latter work will be part of the Navy's placing the barge. They will need some small boat support from H&N; Thaler's people will haul the chain out there, will ask H&N to chip away so they can get at the old chain, etc.

Item 9: Walsh suggested that rather than use a barge which someone else will need later, a separate barge be obtained, because he

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believes that to maintain a position the line must be stretched and the barge left there, then the shot barge just be brought up next to it. It was agreed that if an extra barge is needed, the DOD will provide it.

Conclusion: The system for mooring the weapons barge presented above is considered to be satisfactory from an operational and safety standpoint (particularly with a tug standing by), subject to the conditions and further work noted in Items 1 through 9, above. Reeves expressed agreement with this, if the barge is independent of the system so that when it is taken away the system is still all right -- he would not buy it any other way. Also, he added, this is subject to ONR's doing further calculations which can be reviewed and checked as to certain conditions of wind and current, drift on barge, etc.

IV. FINANCIAL ARRANGEMENTS

Kingsley reviewed the DOD's financial situation; he cannot make a commitment to supply the extra money this barge shot will require, but is hopeful. A request is now in the Bureau of the Budget for a total of about $7,361,000. They have about 2.9 million left over from Ivy. General Luedecke refuses to commit more than $300,000 of extra military funds until the DOD gets this R&D money. Graves did not think this would be termed extra military money, but construction funds, suggested Kingsley should argue this with the AEC. Spain said if the extra military funds can be used for this, it is all right; he thought they could not be used for permanent construction but could be used for test construction.

Kingsley then requested more details on the estimates presented in TG 7.1's TWX J-16685, 5/31/53. Campbell has these, and they will discuss the matter. He would like to have a firm and final figure on how much this will cost the DOD: a firm figure for our estimates, plus the DOD contribution for placing the barge, mooring it, etc., and a promise there will not be any more. However, final cost for stations will not be known until they are built. Spain stated that in the past we have always worked on the principle of paying the actual cost, i.e., he cannot say that should the stations cost more than an estimated figure, the AEC would make up the difference.

LASL feels that the $550,000 estimate is about the firmest we can give at this time.

[redacted]

10 of 12/A - W. E. Ogle
11 of 12/A - H. E. Grier, EG&G, Las Vegas, Nev.
12 of 12/A - ~~LASL Report Library~~ W.H. BURKE

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