W. OGLE TAPES - BC
APRIL 74

411560

As is described earlier, the atmospheric operation planned for early 1962 was set in motion by the president's decision that the ~~xxxxxxxx~~ Department of Defense and AEC should prepare for an operation that might begin as early as February or March 1962. Basis for the president's decision rested with the effects test pleaded for by the DOD to investigate those phenomena that had to do with the ABM problem, that is, with high altitude detonations while the AEC wished to do a number of large yield nuclear tests in the atmosphere and various branches of the armed forces wished to do some systems tests. It was the high altitude tests that actually led to the decision to return to atmospheric testing or to prepare for atmospheric testing. As long as those tests were to be conducted, then the AEC experiments and the DOD systems tests could also be allowed. Two planning limits were placed on the operation: one, the total amount of fission yield to be allowed, a number that was actually not settled for some time ~~(Peron~~ (will have to look up the actual number) and secondly, the duration of the operation. The duration of the operation was to be paced ~~paced~~ by the time necessary to conduct a high altitude portion of the operation and other tests would be allowed within that window. After initial discussions with the proponents of various high altitude carrier systems and with the experimental agencies that had to carry out the measurements, it appeared that the high altitude portions could be ready for a first certification shot in April or May of 1962. These debates had gone on in the period before October 1961. So, in essence, let's say that it would take approximately six months to get ready for the first high altitude calibration shot. The experience of Teak and Orange of 1958 had shown us that Johnston Island was probably the appropriate site for such high altitude detonations. The 1958 high altitude detonations had been moved from Bikini Atol to Johnston Island during the operation when it was recognized that the hazard of eye burn and hence blinding was too large to accept with the great number of ~~marsh leaves~~ Marshallese natives that might view the shot.

Whereas in 1958 the altitudes chosen for Teak and Orange were such that the detonations could not be seen from the nearest inhabited islands, namely, Hawaii.

The DOD desired moderately large yield shots and altitudes therin from 100 kilometers to 400 kilometers. It was quickly recognized that these altitudes would allow the detonations to be seen from Hawaii. Two sets of studies were thus initiated and continued throughout the operation. The first study largely conducted by Group J-10 in Los Alamos attempted to predict the brightness, size & duration of the fireball as a function of the altitude of detonation and the yield of the detonation. The second study largely conducted by _____ (we'll have to look that up), a Dr. Hamm as I remember, a DOD contractor, concerned itself with the characteristics of the human eye from the point of view of the likelihood of burning the retina from such a flash. This study had to take into account the probable size of the pupil at time of detonation, the likelihood of the person having the detonation in his field of view, the size of the focused spot on the retina, heat conduction characteristics of the retina etc. Dr. Hamm had previously conducted experiments on monkeys using laboratory sources and had some initial information on the subject. Both of these problems had some previous history of effort as a result of the difficulty encountered with Teak and Orange during Hardtack, and for that matter, as a result of earlier comparatively low altitude detonations in Nevada, where some of the detonations could be seen from local highways and other inhabited spots. (Si Silver ~~Sizeschlor~~ of the Los Alamos Laboratory had been studying the eye burn problem since the early detonations in Nevada and was of great assistance in these considerations. Also to be taken into account in the problem was the air transmission characteristics between the point of bursts in Hawaii and the effects of ~~retraction~~ refraction because of the changing atmospheric density with altitude. That work was largely carried on again by Group J-10 of Los Alamos.

The initial results of the above work indicated that a number of the proposed possible detonation altitudes over Johnston would be unacceptably hazardous. This led to several rather heated meetings between Task Force personnel, particularly the scientific deputy and his safety advisors, and the technical advisors of the DOD (for example, the Mc Millan committee) on what compromise could be effected. The detonation points could be moved a little away from Hawaii within the limits of the missile systems proposed. However, that distance could not be increased significantly since most of the pertinent measurements had to be made either from the ground on Johnston Island or from small missiles launched from Johnston Island. Some consideration was given to sea launched small rockets, however, the time to develop such a capability was thought to be excessively long. It was recognized that a detonation above approximately 250 kilometers would release most of its energy as x-rays and no large bright fireball in the visual wavelengths would be formed. Thus the shots above that altitude were considered safe although reconsideration of that problem continued right up to the time of detonation. Herman Hoerlein was the main advisor to the scientific deputy on this subject. Shots below 110 or 115 kilometers (check this number) could not be seen from Hawaii so the eye burn problem could be handled as long as there was the appropriate restriction on aircraft and shipping. Hence the danger area declared eventually varied in size with the particular detonation and also varied as a function of the altitude of the observer. The DOD planners felt very strongly that a shot in the region of 200 kilometers was needed since this was one of the favorite altitudes of intercept for the proposed Nike Zeus or Nike X anti-ballistic missile system. A shot at this altitude, could, of course, be seen from Hawaii. This proposed shot involved image sizes on the retina of people in Hawaii that were somewhat smaller than we had experimental information for. The brightnesses

predicted to be
however, were/greater than we had experimental information for. Eventually, a model of the eye burn effects was agreed upon between the effects people concerned that allowed a yield to be chosen for the 200 kilometer height of burst. The largest yield acceptable to the task force was which was then agreed upon as the proposed Blue Gill shot. A lower altitude detonation at I believe 150 kilometers was flatly refused by the task force. A I megaton detonation at 400 kilometers, Starfish, was accepted from the safety point of view for reasons given earlier. During these negotiations, a higher altitude shot of 1,000 kilometers was proposed by the AEC. The yield of that shot was to be 10 kilotons. We better talk to Herman about the purpose I've sort of forgotten. The shot was tentatively agreed upon on the assumption that the field facilities, particularly the number of missiles, and time would allow it. In other words, it was to be treated as a lower priority shot than the other high altitude detonations. Thus, at the beginning of detailed planning there were four high altitude shots proposed. (I'm going to have to review my memory and put in a section on King Fish, I believe it was a shot at 50 kilometers but I've forgotten.) So, at this time there were four shots proposed, King Fish or whatever it was; Blue Gill at 200 kilometers; Starfish, a megaton or a little over at 400 kilometers; and Uraca, 10 kilotons at 1,000 kilometers. During this same time efforts were taking place to try to choose a missile to deliver the devices to altitude. There were possibilities from each of the services and all three services were most anxious to help in this endeavor. The prime contenders were the Polaris missile from the Navy, the Thor missile from the Air Force, Redstone from the Army and to a lesser extent, the Nike Hercules from the Army. The Task Force commander, General Starbird, took the direct responsibility of arriving at this decision seeking of course counsel wherever feasible; in particular, he brought into this consideration his scientific deputy and military deputies.

The basic requirements were that the missile be able to carry the proposed devices, the considerations of safety, the time it would take to get the missile ready for launch, and the reliability of the system. The Redstone missile had been used for Hardtack and the launch site was still available on Johnston Island and the Army had several available missiles in Chicago (I talked to Bill Carter a few days ago and he thinks there still stored in Chicago). The Redstone also had the advantage from the safety point of view that fired from Johnston Island, its range was such that it could not reach any inhabited area. However, the experience of Hardtack was poor. In that case the Task Force had been assured that unless the missiles' went exactly where they were programmed, the warheads could not go off. In actual fact both missiles did not perform properly. They missed their intended burst point, but the warheads did detonate. The system was inertially guided, there was no control from the ground and it did not appear feasible to put in a command destruct for the warhead. During this period of time, Don Schuster of Sandia agreed to assist the scientific deputy of the task force by taking over the major high altitude operational technical considerations for the scientific deputy. He then joined Starboard and Ogle in the debate on which missile system to use and contributed greatly to the final decision. Starboard, Schuster and Ogle all felt very strongly that the system to be picked should have a command destruct system for both missile and warhead and that the site should be set up in such a manner that the appropriate data would be available to make such decisions. The latter point meant that if possible it was preferable to have a missile with sufficient range that the warhead could be lofted to very high altitude and fall from that altitude to the desired detonation point, thus allowing appreciable time to interpret tracking data to see that the warhead was going to the right place and to make the appropriate considerations, and would allow destruct if necessary. Having such range, however, introduced the difficulty

that if the missile got out of control it could reach a number of inhabited areas, most prominently the Hawaiian Islands. There is also the emotional advantage of a short range missile that the time from launch to detonation would be so short that those in control would not be able to make any decisions, hence ~~releaving~~ relieving them from the responsibility.

The Navy offered the Polaris missile which could be launched from the surface ship ~~of the~~ (O)bservation (I)sland and hence could carry whatever RV we built to fit it without submarine launch considerations. This offer had the advantage that the launch site was already built; however, the observation island had some time restrictions on it. The reasons I've forgotten and I guess we'd better find out. I'm not even sure the name Observation Island--we'd better check that. It did appear that cooperation between the task force, the rv builder and the Navy would be difficult. And, a sea based launch with all the rest of the instrumentation on Johnston Island led to some hesitation on the part of the task force.

Nike Hercules did not have the range for most of the shots proposed nor could it carry the warheads desired. Furthermore, it appeared that it would be difficult to put in all of the destruct features.

When these considerations were first entered into in the fall of 1961, the Air Force had put aside some half-dozen Thor missiles for possible task force use. However, as time went on and the task force began to look favorably also on the Polaris missile, the Air Force released these particular Thors. In spite of this, the Air Force and their contractor, Douglass, were most enthusiastic and convincing in their descriptions of the advantages of the Thor missile. They had done their homework well, ~~hand-in-hand~~ and had in hand the schedules required for the ~~bitting~~ building of the launch site on Johnston Island and the required changes in the missile. (I forgot to mention that one of the considerations of the missile was that it

be able to carry experimental pods to be released in such a ~~matter~~ manner as to provide high altitude observation points for the detonation. In particular, the Air Force was confident that they could do the work necessary to carry the pods on the appropriate time scale.

Thus, the choice narrowed down to Polaris versus Thor, and eventually, Starboard chose the Thor not only for their technical reasons and safety reasons, but because of a bit more confidence in the personnel who would be involved. Then, of course, came the blow after the task force was committed to the Thor we discovered that the original bright and shiney Thors had been given other programs and by then it was too late to go back to the Polaris without delaying the readiness date for the operation. However, the Air Force scrounged the country and eventually found eight essentially scrapped Thors that were being used as monuments in front of Air Force ~~basis~~ bases and other such things and set to work refurbishing them. Thus we had six Thors for five shots allowing us one spare. The five shots being the four actual detonations and one calibration shot ahead of time to make sure all the systems were working.

During this same period of time, negotiations were entered into between the Task Force and the Pacific Missile Range to furnish tracking and safety capabilities. PMR agreed to furnish that equipment and personnel, at the same time Sandia agreed to take on the job of producing the rv's, the associated circuitry not only for detonation but for destruct.

At the suggestion of Schuster and Ogle, Starboard "drafted" Major Roger Ray to assist in designing and setting up the electrical and human systems that would actually make the safety systems usable. Basically, PMR was to take on the range safety and missile destruct job, but the Task Force under Schuster and Ray would take on the device destruct job.

During this same period of time, appropriate considerations concerning the devices to be detonated in high altitude shots were taking place. It was essentially mandatory that the devices be ~~stock bound~~ Stockpile weapons that had been tested. Now I've forgotten a point and I guess we have to go back to the books to find out, but I'll say it the way I remember it. I guess my memory of King Fish is wrong. Anyway, the desire was to have at least one moderately clean device to check out the difference ~~between~~ in radar attenuation effects between devices with a large amount of fission and devices with less fission. Entering into these questions were the considerations of whether the laboratories could furnish the devices required with appropriate fusing changes and whether those devices would take the accelerations furnished by the Thor missile. Thus, discussions were held between the task force staff, Starboard, Ogle, Schuster and others, and the laboratories, including Sandia, and the DOD personnel responsible for the experiments on the shots, mainly DASA. Eventually, the following warheads were agreed upon: there is no point of me listing them here because I'll get them wrong, we'll have to look them up in the books. During this same period of time, experimental program for the high altitude shots was being designed and put together. While the main purpose of the shots were to investigate the effects of high altitude detonations, it was recognized that a number of other effects were also important and could be investigated at the same time. Primary amongst these was the desire to obtain genuine x-ray ablation effects measurements on possible rv materials. The prime method of determining these quantities is thru the use of three pods to be attached to each missile. These pods would be released during flight at such a time as to be the proper distance from the detonation at the time of detonation. The pods design and construction itself was carried out by DASA contractors (better check that it

might have been an Army contractor). Whereas as the same time Douglass was busy with calculations on wind tunnel tests to show that the pods could be carried by the Thor without ~~xxxxxxxxx~~ being detrimental to the flight.

The AEC laboratories, particularly in Los Alamos, as a result of experience gained during Hardtack and earlier were convinced that good optical coverage of the event would also produce information of value to the radar attenuation question. Thus, ~~Herland's~~ Haerlin's group at Los Alamos with the assistance of a great number of other people in the laboratory, began to plan and prepare for optical coverage from Johnston Island from Haleakla and from an aircraft, ~~field~~ tail number 136. This coverage was to eventually provide some of the most valuable ~~xxxxx~~ information to come out of the operation. DASA was also preparing for a number of other effects. While the pre-shot predictions for Dominic as to effects were in general very poor, nevertheless, it was recognized that some of the material for some of the higher shots would follow the field lines of the earth's magnetic field and the question of where they went and what the phenomenology there was was pertinent. Thus, DASA had to arrange through its contractors for instrumentation at some of the more remote southern islands. They had optical stations from Tonga ~~Fiji~~ Tapu, Fiji, ~~Pago Pago~~ Samoa, Christmas Island, and others. A corresponding job for the Task Force was to arrange with the appropriate foreign nations for sites and support for these experiments. It was also necessary for the Task Force to describe to these remote islanders some of the effects to be expected so as to attempt to prevent fear and ~~untold~~ untoward actions on their part. As an aside, it turned out to be necessary to offer free air shipping for a couple of 124's full of paint for American Samoa in order to get the local government's full cooperation there. This paint was required in order to pretty up the village of Pago-Pago for the forthcoming pacific island governors conference.

Governor Lee sure had a couple of beautiful daughters.

Previous work had shown that such detonations affected long range communication seriously. DASA therefore set up communication gear over the entire pacific basin, including granger sounders to observe the movements of the ionosphere as they might be affected by the detonation.

It was recognized that one of the necessary inputs into the calculations of radar attenuation would be the x-ray characteristics of the ouput of the bombs. It was therefore clearly necessary to measure this quantity; both the DOD thru the use of small rockets from Johnston and the AEC using small rockets from ~~Kauai~~ Kauai and Vandenberg tackled this experiment. The AEC because of the interest in remote detection, engendered through the Vela program at the same time, took on the job of measuring the neutron spectrum by time of flights from detonation above Johnston Island to rocket-borne detectors above ~~Kauai~~ Kauai in Hawaii.

DASA also arranged for actual debris collection from high altitude balloons at the southern conjugate point.

Meanwhile, back at the farm, consideration for the other parts of the operation were taking place. The AEC laboratories ~~at~~ had had a few months experience with underground testing in Nevada. It was quite clear that the larger devices that needed testing could not be tested there in any reasonable length of time. This was all in the atmosphere of suspicion on the part of the laboratories that a test ban treaty would be signed fairly soon so there was urgency to get a number of warheads and possible warhead designs tested. The very beginnings of the ~~Merv~~ MIRV possibilities were showing up and both weapons laboratories wanted to test several possible designs of 100 kiloton and 100 lb. devices. A few large devices had been put in

stock pile during the moratorium as worthwhile testing some versions of those. Specifically, Livermore wanted to test the 56 new low megaton yield warhead for the Polaris system and I guess this section really ought to be written with a shot list in front of one. Operationally, the first problem was where could such tests be conducted. While the U.S. had not formally given up the Eniwetok proving grounds in 1958, the resistence of the ~~Marsh leaves~~ Marshallese natives to further testing in that region had become quite clear. The repurcussions in the U.N., were we to go back, were feared on the part of the federal govenment. Nevertheless, discrete inquiries were made. State Department advised promptly that we should not reconsider the Marshall islands. There were many possible methods of testing but the prefered method was similar to that which had been used previously at Eniwetok of placing the devices on a well-moored barge, firing by land mines and making observations with a stable geometry. If that method could not be achieved, then surface shots on the land would be preferable. However, at this time, it became clear that whatever we did should be done in such a manner as to reduce fall-out as much as possible where fall-out varied between a requirement for low intensity local fall-out and requirement for low intensity remote fall-out, hence meaning high intensity local fall-out. Other uninhabited sites such as Taongi, French Frigate Schoalls, Baker Island were considered but rejected for operational reasons. Christmas Island had been mentioned but the initial reaction was unfavorable because the island was claimed by the British. The basic requirements for a site for experimental test devices, detonations was that it be reusable, that the distance from the shot to the fireball cameras be precisely known, i.e., within approximately 1% of the distance, and that it be within range of sampler aircraft. Eventually, in about October or November 1961, it was clear that the test organization could not meet the hoped-for test operational dates unless it began preparing

for some method of testing. Thus, thru Task Force offices, some three liberty ships were obtained plus several active Naval ships for instrumentation. The intent was to use each liberty ship as a barge on which to place the device to be detonated and to observe that detonation with cameras and other equipment from the navy ships on the ground and from two instrumented 130 aircraft obtained for that purpose from the Air Force at the same time. Distance was to be obtained using radar that Sandia would install on the navy ships. These are something 26 radars, I've forgotten the designation. Task Force arranged for direct working relations between the laboratories and the navy in preparing these ships. The operation was to take place some 600 miles southeast of Hawaii. This point being chosen because of the prevailing winds. We were concerned about the Tsunami problem, but at that time, had not done sufficient arithmetic to show what is now pretty clear, that it would have been a serious problem. This method of operation was not satisfactory to the AEC laboratory, the measurements would clearly be of poorer quality than desired. Sampler aircraft would be operating at maximum range and a great deal of dependence would be placed on photographic observations from the C130's, a type of work that had not been done before. So pressure continued to find some more suitable site. The Task Force largely through the auspices of the navy deputy (rear admiral Loyd Mustin) decided to have its headquarters on Ford Island in Hawaii. An office building was obtained and refurbishing began. Incidentally, since the headquarters was to be in Hawaii, I insisted that there was no reason why we couldn't have female secretaries. The Task Force agreed that I could have Miss LaPlant as my secretary in the field. The major difficulty, however, was that the office building obtained on Ford Island had no ladies john's. The Task Force, therefore, put into the plans the production of such a facility and I believe it was actually constructed before we gave up that plan.

During this same period of time, however, September, October, November of 1961, negotiations had begun with the British for the use of Christmas Island. The British were quite anxious to have us go ahead with weapons development and they were quite anxious for us to use Christmas Island. However, they had a number of restrictions which were most difficult for the U.S. Perhaps the most difficult was that they wished to know what each shot was for including in moderate detail weapon design and to prove that shot is worth doing before we could do it. They did not want any land based or lagoon based ~~land base for lagoon based~~ shots because they did not wish to cause that much damage to the island. The island incidentally was in use as a Coconut plantation manned by Gilbertese natives brought in by contract by the British. A New Zealander was the local administrator. They also wished to have a safety veto, particularly as regards to weather, and they wished to have the right to make measurements on the shots themselves as they might desire. In hindsight, I do not think the British thought these were restrictive requirements since we had been exchanging weapon information with them for some time and they felt it clearly was their island. However, these requirements were not acceptable to the U.S. It was particularly unpalatable to the U.S. to have its test program subject to the judgement of another nation.

While these considerations were being debated, the U.S. sent a survey team to Christmas Island. This survey was requested by the Task Force arranged thru the State Department and was kept most discrete. The survey consisted of the scientific deputy of the Task Force, several technical representatives, engineering representatives from H4N. ~~Homes and Arver~~. The British had retained a small garrison on Christmas Island presumably in case they wanted to go back to testing and also to continue to maintain their claim of ownership of the island. Perhaps the most outstanding feature of the survey was the

surprise and pleasure that the Americans took in having their shoes shined every night and having tea delivered to the room in the morning. The survey revealed the eminent acceptability of the island as a test site. The old quarters and office buildings erected by the British for their tests there earlier could be put into usable shape without too much effort. The power plant was questionable, in fact, inadequate. The water supply would hardly ~~do~~ do. Their water came from small wells into the ~~lends~~ lens of fresh water on top of the salt under the island and there were no adequate docking facilities, materials would have to be lightered ashore. The air field was adequate, although somewhat shorter than desired (would require some work). The shots would have to be fired off the south end of the island, either as ~~barged~~ barge shots or air drops and observed from fixed stations on the island, which then would require tracking radar to obtain distance measurements. This radar could be the same radar we were presently installing on the ships. The road from the campsite to the required observation point was in good shape, although narrow and perhaps hazardous. However, the British insisted that we would have to follow their traffic rules and drive on the left-hand side of the road because otherwise their people would get confused and get into accidents. An initial full layout plan for the technical instrumentation and shot point was drawn up during this survey and agreed to by the British representatives there. The British representatives were most cooperative and clearly intended to do everything they could to help.

I might mention at this point that during the considerations for further test programs after Dominic in 1963 and 1964, it was quite clear to the technical community that Christmas Island was a much more preferable site for high altitude operations than Johnston Island. That judgment probably still obtains if we ever go back to testing if the political diplomatic

problems with the British could be solved.

During these considerations, one possible path occurred to the Americans, Christmas Island is a contested island. The British claim it but so do the Americans, the British claim coming about apparently as a result of Cook's visit there, the American claim coming about due to occupation of the island in World War II. We could, therefore, in some manner insist on using the island without satisfying the British demands. However, this consideration was never taken very seriously.

The time the Christmas Island survey came and sent in their recommendation, the diplomatic difficulties had been worked out between the British and the Americans with respect to the British restrictions on the use of the island and the decision was made to switch the scene of operations to Christmas Island and to do the shots by air drop. I want to mention this now so I don't forget it although it probably should be placed somewhere else in the report. As part of the Christmas Island machinations, the Task Force at my suggestion arranged that there should be no restrictions on personal photography. The restrictions on personal photography in previous operations had been an onerous one upon those members of the organization who liked to have momentos of where they'd been and what they did, and in principle, except for actual pictures of a device, there was nothing that one could obtain by ordinary photography that was classified. General Starboard agreed to that policy and it existed through about half the operation. At that time, however, two things happened: 1) someone had to abuse the privilege and sold a number of pictures of Christmas Island detonations to a Seattle newspaper that made headlines and since the government had been trying to keep the whole operation as low key as possible, it caused great pain in executive circles; 2) Admiral Muston and I paid a visit to President

Kennedy at which Admiral Muston with his normal flair took along a ~~asse~~ large series of carefully prepared and quite beautiful photographs of a number of the detonations and of other things on the island. After President Kennedy looked at the photographs with interest, he raised the question of how widely distributed the pictures were. After some hemming and hawing, the Admiral answered that numbers of people in the government had copies of them, which was rather horrifying to President Kennedy; he felt that all pictures should be closely held even within classified government circles and made clear his desire for such a policy. As a result of that, not only was it necessary to take personal cameras away from all the personnel in the Task Force, but it was also necessary to set up a system for internal use of photographs that was onerous for some years afterwards.

It now became necessary to implement the Christmas Island decision. The laboratories immediately began tearing the equipment out of the ships, or if the equipment was not there, get there, preparing to ship it to Christmas instead. Sandia accepted the job of setting up a tracking radar system that would not only track the B52 drop aircraft but would also track the device as it fell. Sandia took on the job of packaging the devices for an air drop using a bunch of reworked 36 cases and putting on the appropriate fusing systems and beacons. A facility for handling the weapons was designed and built or arranged for (we'd better look that up) at Barber's point in Hawaii. It had been decided to deliver the bombs by B52 from Barber's Point. The strip at Christmas Island was somewhat short for the 52 and we did not have the proper weapon handling facilities there. Barber's point was picked instead of Hickam because we did not want to put test devices or weapons into the Hickam air field. Sandia and the weapons laboratories took on the job of

designing, operating and maintaining the weapons complex at Barber's Point in conjunction with the Air Force. That, incidentally, caused a bit of trouble which would be fun to discuss with Hollingsworth. We arranged for marine guards with the weapons assembly facility; unfortunately, Marines take their job seriously whereas the civilians seem to be somewhat lackadaisical. We had a number of incidents in which the marines, perhaps by having improper orders, made sufficiently threatening gestures to the civilian personnel that the weapons teams threatened to quit and come home rather than operate under such conditions. It took a ~~paramount~~ fair amount of administrative effort on the part of the Task Force to straigten out that small difficulty. I should interject at this point that Lee Holingsworth of Sandia had accepted the Task Force offer tendered by the scientific deputy to be in charge of all weapon assembly and handling for the Task Force. He did an outstanding job. The sampler aircraft, however, which had been planned to operate out of Hawaii now had to ~~ship~~ shift to Christmas Island. This was an appreciable benefit in most ways because they would be much closer to the clouds to do a better sampling job. However, some difficulties were experienced, the logistics at that distance were somewhat of a problem, ~~they washed~~ the wash-down pad had to be provided, but the British were rather sensitive about the disposal of radioactive water after the planes were washed down and a sample return system had to be provided. That latter was done by KC135 tankers lightly loaded, no passengers, taking off from Christmas Island and flying direct to the West Coast of U.S.

The fireball procurement systems which had already been under preparation for the ship operation were taken as soon as possible to Christmas. That part of the operation was under ~~egg~~ EG&G auspices, fireball cameras were mounted on tracking gear for the tracking, information was furnished on the Sandia

radar, there were also wide angle fixed cameras, and it was also planned to back up these measurements with measurements from the C130's that had been procured for the sea-based operation. Sandia produced in this time a distance measuring system (DME) operating in the C130's using a beacon in the drop cases. The time interval measuring gear by all methods was installed both underground and in the C130's. When scheduling allowed it, the LASL KC135, tail number 136, procured and instrumented for observation of the high altitude shots, was also flown at great ranges against the air drop detonations as a further back up. This is perhaps time to mention the difficulty with the tracking radar. Several of us, (certainly myself) felt very strongly that the tracking information on the position of the drop B52 should be available in real time at the control point of the island. This feeling came about not only because of the previous experience with air drops in Nevada, but, specifically, because of the experience of the Cherokee shot on Bikini in which the Air Force had missed the target by some 5 miles. Our closest-in observation points for the Christmas Island detonations were a distance similar to that and part of the planned orbit of the drop aircraft went fairly close to being over manned stations. Therefore, I wanted to know where the airplane was at all times. The Air Force, however, well-represented by "Black Sam" Samuels, felt that the possibility of operational control from the ground was undesirable, showed a lack of confidence in the Air Force and was not acceptable. The result was that the information was initially not available except by telephone at the control point but was available in the Sandia tracking trailer at A site. Early in the operation, surely enough, the B52 got on the wrong target and managed to orbit directly over the manned ground-based stations. This led to a prompt outcry on the part of the tracking system which was relayed immediately by telephone to the command post and from there through a somewhat cumbersome system to the B52. Whether the incident

could have been really serious was never completely decided. However, it was serious enough that there was no further argument on the subject and the tracking information was brought to the control point from then on and actually became somewhat of assistance to the bombardier in checking his tracking orbit. Once the operation was planned for a land base at Christmas Island, DASA requested the addition of a number of effects experiments which were accommodated where operationally feasible. For some number of operations, they had been trying to design and provide optical shutter eye glasses for airplane pilots to prevent flash blindness in warfare. Several stations were set up close to A site to test such devices and to obtain optical information for further design. DASA also wished to add an experiment that caused a great deal of mental anguish on the part of the Task Force safety people, particularly the commander and the scientific deputy. This experiment was a continuation of a long series of measurements that had been made in past operations and was an attempt to measure the response of aircraft in flight to the thermal burst from large yield nuclear detonations. The aircraft to be used were B57 C's instrumented to observe skin temperature and stress. To perform the experiment, it was necessary to fly a B57 right through the shot point or immediately below or above just a few seconds before detonation (where a small few seconds, in one case, I believe was as as 3). The possibility of miscalculation was a very distrubing one to the Task Force commander. We had to take into account the probable bombing accuracy of the B52, the timing of the B57 and other similar factors. It is clear that if the timing were not right, the pilot could get into an even worse situation by trying to abort. A variation of the experiment that was somewhat safer than proposed was eventually agreed upon. The final data obtained were perhaps the best data every obtained on this type of experiment but largely

because one of those miscalculations occurred so that the plane actually got as close to the detonation as the original proposal had desired. As another aside, I should comment on personal communications, the telephone communications from Christmas were very poor; in fact, they may not have existed, I've sort of forgotten now. They were restricted to offical use. There was, as had been so in previous operations, a demand on the part of private individuals to occassionally make contact with their loved ones. So a Hams radio station was set up, by Livermore I believe. The Livermore people tended to use it when the official communications were closed to them because they didn't have sufficient priority and at least on one occassion, the final operational decision on the part of Livermore Laboratory and the AEC in the case of one shot reached the Task Force Commander via Livermore personnel on the island using their Hams radio some hours before it reached him in the official communication channel. This was, of course, somewhat distressing to the military communications system personnel involved.

In parallel with the technical moves, the logistic problems had to be faced. The island construction, maintenance, feeding etc. problems were taken on with enthusiasm and vigor by the AEC contractor, ~~Holmes and Narver~~ H&N. The armed ~~forced~~ forces, particularly the Navy, offered a great deal of assistance in the way of material. ~~Holmes and Narver~~ H&N worked on the island, was in charge of Riley Shaw who was a harrassed man throughout the entire operation. The British power plant operated at 50 cycles and the normal distribution system was at 230 volts. That's a great amount of American gear ~~but~~ that would not work off of it. Thus, ~~from~~ some auxiliary power for technical equipment had to be furnished and H&N brought in generators for that purpose. The British water system was completely inadequate for American needs; while it was used for a little while, sea water stills were brought in and installed to furnish fresh water as soon as possible. The housing facilities had to be refurbished and the appropriate

furniture shipped in and distributed. And, as you might guess, in the midst of all this it became clear that we were going to have an influx of VIP's and, of course, British housing would not be adequate for such personnel, so it was necessary to bring in pre-fabricated housing trailers of higher quality to establish VIP quarters. This helped the morale of the island personnel no end. The major difficulty faced was in feeding at the main camp. The British cooking equipment was somewhat worse than our people were used to. There was a great shortage of eating utensils, dishes, cups and, of course, at least for a while, these received comparatively low priority on air shipment. It was necessary to feed in shifts very quickly because the personnel on the island grew faster than the feeding capability. The mess hall was cafeteria style; unfortunately, the exit was close to the entrance and because of lack of sufficient personnel it was necessary to require that the patrons carry their own utensils, eating trays to the exit and dump the garbage there. That made the whole process somewhat unpalatable for those coming in. There were many other problems which Riley Shaw fought long hours every day. I should have mentioned that when we moved into Christmas, Col. Phil Hooper, the oldest col. in the army, was brought in again because of his well known trouble shooting capabilities as island commander. He along with Riley faced the problems I mentioned above. The feeding problem eventually became so serious as to lead to demonstrations in the mess hall and incipient mutiny. At this point it became necessary for Starboard himself to take a hand not only in arranging for higher priority in the shipping system for material but also to help bolster the morale of the personnel by visiting the mess hall and eating there most of the time while he was on the island. Perhaps worthy of note here was that, in parallel with the build-up of the island, a most adequate officers dining room was set up at the suggestion of and under the auspices of the navy deputy who also

arranged for the importation of an adequate number of Philippino mess attendants for navy personnel. It was somewhat embarrassing to eat in those pleasant and even luxurious surroundings knowing that a few hundred feet away most of the people had to eat in the rather degrading circumstances that were the best we could furnish at that stage of the operation. It took most of the duration of the Christmas Island operation to straighten out the messy problem. The problem of getting the materials to the island by other than air was a serious one, since there were no docking facilities (we should look this up in the records, my memory is that we got the navy to furnish one or two LSD's for a trip or so to land on the beach and we eventually dredged a channel a little bigger so that we could use better lightering facilities, it was a serious problem).

The British, however, did have one facility that lightened our daily burden appreciably. They had a very nice 40 foot boat rigged up for fishing and some of the best fishing in the world is off of Christmas Island. While this facility was not available for everyone and could not be used all the time, it was nevertheless a great help. There was also very good shore fishing for white fish in the lagoon, and longustas could be obtained by the truckloads. Christmas Island was not as nice as some of the other atolls for swimming although it was not too bad in some of the smaller lagoons or lakes. The lagoons with openings close to the ocean were shark infested and only in a few spots on the island could one get to good ocean swimming. In the problems of setting up the appropriate command and control apparatus, the island communications to Hawaii and U.S. were difficult but were done in an exemplary fashion by the then J-5.

In order to drop the bomb, it was not only necessary to provide drop cases that would accept essentially any odd shaped device the laboratories came up

With, a job very nicely done by Sandia under Shuster and Holingsworth, but was necessary to furnish and modify one or more B52's as drop aircraft. The bombing procedures and equipment were of necessity somewhat different than those used by SAC. This job was accomplished by the Kirtland Air Force, whatever their name was in conjunction with Sandia personnel in a remarkably short time. I will mention here a small problem in command and control that gave me a heartburn during the operation. Since it had been operated in so many places, it was necessary for Starboard and I to fly back and forth between Johnston Island, Christmas Island, Hawaii, Washington etc. At the time of the particular incident I am relating Starboard and I were on Johnston Island preparing for a high altitude shot while an air drop was being prepared in Hawaii with Admiral Muston ~~at~~ in control at Christmas Island. In the midst of our ongoing and continual flap on Johnston Island, we received word that one of the LASL devices was in ~~XXXX~~ Barber's Point. The problem in my mind was clearly the question of the safety of the B52 crew from the point of view of While we were pondering that question, word came from Jim Hall of LASL to go ahead and drop the bomb and the communication system was such that I didn't catch it until they were half way to Christmas Island. From the lab's point of view the problem was to fire the bomb before the down to where the bomb wouldn't operate properly. I would have stopped the ~~shop~~ shot had the communications allowed it, at least until I was sure of the safety problem. HOwever, to the best of my knowledge, nothing untoward occurred.

I should also mention here the problem of target crafts. The Cherokee shot ~~had~~ at Bikini had taught us that we wanted nothing to do with offset bombing if we wanted a target. The target was also helpful from the experimentalist's point of view in being able to point his apparatus at peace and quiet before the bomber appeared overhead. ~~However, the position agreed to for the~~

However, the positions agreed to for the detonations between ourselves and the British was over quite deep water and the navy did not at that time have the expertise to moor either vessels or rafts in water at that depth. If memory serves me right, it was about 15,000 ft. (We can look that up) However, a gentleman from Scripps, whose name I can't remember at the moment, works in tsunamis and earthquakes and so on, (works for Willard Baskin) had been doing experimental work in deep water with a new type of mooring philosophy and was quite sure he could do the job. We had the normal administrative go around with the navy who did not wish to learn any new techniques but simply wished to say we couldn't moor the rafts there. However, that was eventually overcome. The mooring system basically consisting of deep sea anchors with ~~buoyant~~ buoyant nylon ropes or plastic ropes was eventually installed and operated satisfactorily throughout the operation. Procurement of the rafts themselves was also somewhat of a slip since we wanted not only radar reflectors on the rafts but beacons if possible. As I remember the design was achieved as a result of a debate between the Air Force and Navy and ~~Homes and Arver~~ H & N and while there was some sweat about procuring the rafts on time they eventually ~~poared~~ appeared in time for the operation.

As part of the philosphy of operating at Johnston Island and Christmas where facilities were limited we kept everything possible back at ~~Hickum~~ Hickam. This required facilities both for the AEC and for the laboratories and for the military there. These facilities were largely procured by accommodating Task Force activities dealing with the military (in particular with CINCPAC), and ~~Homes and Arver~~ H & N also dealing with both military and civilian contractors. A trailer park was set up on Hickam to furnish laboratory office space for laboratory personnel, both AEC and DOD, and a fair amount of space was loaned to the task force for the use of the Air Force both for administrative space

and operative space. The coordination center for coordination of all remote sites involved in high altitude operation was centered at Hickam; communication problems to accomplish this was serious.