Starbird discussed Revelle's suggestion with Luedecke on March 14, noting that he had planned so far to conduct the exercise in the Christmas area in order to utilize resources that would be there for other purposes. With respect to moving the event, he said:

> It would require substantial added resources to conduct this experiment in the alternate Wigwam area. We shall immediately investigate what is needed in this regard. In addition, it is probable that use of the alternate area would require the declaration of a danger area not now contemplated, although no such danger area was declared for the Wigwam event in 1955.

Since the selection of the nuclear weapon test sites had been assigned to the AEC, General Starbird raised the question with the Commission during his briefing on March 28, outlining the whole program. Starbird noted that while he was aware that the Wigwam area was known as a "fish desert," he had planned to conduct the shot in the Christmas Island danger area for operational reasons. He had read the preliminary comments of the Division of Biology and Medicine (AEC), which concluded that a very few commercial species of fish would have a measurable but not hazardous level of radioactivity, and probably the number of fish which could be caught and have a measurable degree of radioactivity would be between 7 and 70. However, he noted that both Scripps Institute of Oceanography and the Wood's Hole Oceanographic Institute recommended that the shot be moved to the San Diego area, and that Secretary of the Interior Udall had also asked the AEC to reconsider the planned location of the test. He went on to say that he would continue to recommend that the test remain in the Christmas Island danger area, but if it was moved to the Wigwam area, he would ask that the Navy conduct it. Mustin noted that if the tests were conducted in the Wigwam area, it would be necessary to acquire the services of an additional LSD, an additional tug, approximately six P2V aircraft, and three additional aircraft for weather reconnaissance information. He could not comment on the availability of the additional resources at the required time. The planned shot date was only six weeks away (May 18 to May 23).

The Commission discussed the subject again on March 30 with Roger Revelle, Spurgeon Keeny, Gerry Johnson, Admiral Mustin, and Dan Rex (the Task Force weather officer) present. Task Force representatives continued to favor the Christmas Island area. Mustin revised his estimated added requirements to approximately ten aircraft, three ships, four small Naval craft, and 800 men, if the test were conducted in the Wigwam area. Dan Rex presented data to show that the weather was somewhat more favorable in the Christmas Island area and Mustin estimated that it would take approximately five days to conduct the test in the Christmas area, but ten or eleven days in the Wigwam area.

The representative of the AEC Division of Biology and Medicine, Dr. Dunham, opined that it was virtually certain that someone would discover tuna or another commercial fish which would have experienced a measurable but not dangerous increase in radioactivity as a result of the Swordfish test, if conducted in the Christmas area. After discussion among Revelle, Dunham, and Mustin, it appeared clear that there was no actual hazard, but there could be no guarantee that the Japanese, who fished the area fairly heavily, would not catch some nonhazardous but radioactive fish. The result was that in view of Revelle's position, and as public evidence of the AEC's concern with safety, the Commission approved a relocation of the Swordfish event to the Wigwam area.

General Starbird raised the question of a Wigwam exclusion area with the Commission on April 12, stating that the area should be some 70 by 100 miles, but also noting that the absence of commercial fishing vessels with only a small amount of merchant shipping in the Wigwam area supported his recommendation against

establishing a danger zone. Gerry Johnson concurred for the MLC. The Commission agreed it would not be desirable to establish an additional danger area at the Wigwam site.

Thus, by mid-April the Navy laboratories (NOL, NEL, NRDL, etc.) were prepared to make appropriate measurements in the water, in the air, and on the ships. EG&G furnished the common timing signals and the AEC took on the job of monitoring the radioactive pool and determining the marine life effects. A towed test array was designed consisting of a ship and a number of coracles from which hung instrumentation. Bill Murray of the David Taylor Model Basin was the Scientific Director for that shot and Capt. Ben Petrie was the Task Unit Commander.

Thus, by April 24, when the President announced the resumption of testing, the Swordfish system had been designed, most of it put together, and the shot point had been chosen. The system was being assembled in San Diego and was preparing to rehearse.

The Polaris System Test

After President Kennedy's March 2 announcement on test resumption the JCS promptly requested that the previously considered Polaris system test be included in the series, and by March 7 it had been approved. The appropriate command and control systems had already been developed before the November 29, 1961, NSC subcommittee meeting, which had decided to delete the test nicknamed Frigate Bird. The appropriate missile and warhead destruct systems had also been designed and were being built in the interim.

The reinsertion of this shot at such a late date caused an appreciable flurry in the Task Force. Starbird and Ogle had no time for detailed study of the fusing and firing systems because they were deeply involved in preparations for the Christmas Island and Johnston Island operations. Scheduling was an immediate problem, planning still being constrained by the Presidential directive to make the operation as short as possible, once started. Starbird felt very strongly that the high-altitude portion of the operation would demand great attention and that, therefore, Frigate Bird could not be fired during June, or even in the latter part of May. (The three high-altitude shots were scheduled for June 1, June 5, and June 30, roughly.) The Polaris boat Ethan Allen was in the Atlantic at the time the decision was made, and no one wanted to consider establishing another danger area. Furthermore, it would be better to have the shot before Tiger Fish (the first Thor launch from Johnston Island), which was scheduled for May 1, but the Ethan Allen could not get to the Pacific that soon. Therefore, Starbird insisted that the Navy move as fast as possible in order to fire during the first week of May.

A second problem was the determination of the launch and burst points. The initial suggestion was to fire into the Christmas danger area from a position near Johnston. This had several operational advantages, among which were that the Task Force Commander would be able to spend some time satisfying himself concerning the launch safety conditions, and observations could be made using equipment at Christmas Island. However, it had two fairly serious disadvantages over the other possibility, which was to launch toward Christmas from a point roughly due east of Christmas. The first disadvantage was scheduling. The Ethan Allen had to transit the Panama Canal, and the travel time from there to Johnston Island was appreciably longer than to the position east of Christmas. Secondly, while there clearly was a range safety system of sorts and a missile destruct system, there was not time for Ogle and his safety advisors to go into the details. Therefore, it seemed wiser to launch the missile from a point where its range would preclude reaching inhabited land, no matter what

its trajectory. Thus, a launch point was picked more than 2,000 miles east of Christmas Island, with the burst point somewhat to the northeast of Christmas. To preclude serious eyeburn Ex.(b)(3) the burst point was to be far enough from Washington and Fanning and other inhabited islands that people on those islands could not see it. It is interesting, in retrospect, that we were willing to launch from a point outside the danger area, but apparently the point did not arise then.

The Navy was anxious to specify the burst point and the yield of the device since, after all, the point of a systems test is to prove that everything operates correctly. The initial plan did include a plan to determine the burst position and yield by using two submarines near the burst area equipped with cameras and bhangmeters operating through a periscope. In addition, a plan was made to use the airborne diagnostic equipment devoted to the Christmas Island operation. Thus, in the last few weeks before the first nuclear test there was quite a flurry of activity on Christmas Island in an attempt to set up such a capability. Both the Navy and LRL also wanted radiochemical samples for yield determination, if possible, and TG 8.4 studied that possibility during those last few weeks.

A further serious problem was communications. Starbird felt that the test should be under the operational control of Admiral Mustin, the Navy Deputy, and, furthermore, he could not himself afford the time necessary for sea transportation to a ship 2,000 miles away. However, Starbird took his responsibilities strongly to heart, and therefore felt that he had to have good communications with Mustin. Thus, in still another way, the last few weeks before the beginning of the operation involved a great deal of effort trying to establish effective and reliable communications. Unfortunately, proper communications checks could not be made until the ships were near their designated area, which was to be some time after the beginning of Dominic. A further need for good communications was to notify the diagnostic aircraft and submarines of burst time, and doing this required prompt notice of launch time from the Ethan Allen.

Once permission was given, the Navy moved rapidly. The four test missiles were modified by the Navy Weapons Annex in Charleston under the technical direction of the Navy Special Projects Office in time to allow sailing of the Ethan Allen on April 19. The missiles were provided with a destruct system and a beacon for tracking by the missile flight safety ship, the Norton Sound. Tests to ensure compatibility of the destruct systems on the Norton Sound and on the missiles were made using equipment flown back and forth across the country several times. Appropriate parts of the flight safety system were installed on the Norton Sound at the Pacific Missile Range yards, and she sailed on April 27, eight weeks after preparation for the tests was ordered. Other equipment on the Norton Sound included gear for special underwater and radio communications needed to communicate with the submarine in the submerged condition and with the Task Force Commander at Christmas Island.

Thus, when the President finally ordered the resumption of testing the Frigate Bird array was already at sea.

The Atlas System Test

The JCS and the Air Force also obtained approval during the week of March 2, 1962, to reinstate the previously proposed test of an Atlas missile system. The shot would be fired from Vandenberg AFB in California to a target area somewhat north of Johnston Island, but in the Johnston Island danger area.

Starbird, whose arm had been twisted to induce him even to continue taking responsibility for the Polaris shot, could see no way to take operational responsibility for the Atlas effort. The attitude was not displeasing to the Air Force, so the

arrangement was quickly made that the Air Force would be responsible for the launch and for range safety near the California coast, and the Task Force would be responsible for safety on the far end and for what diagnostics would be accomplished.

It is noteworthy that the AEC laboratories were not particularly happy about these added tests. From their points of view, it was the same old thing that had happened many times before. The military proposes a systems test; tells the President that they can do it in zero time because, after all, it is an operational system; and then when approval comes, they need help. The point of a systems test is, of course, to see whether the system will work, including the final explosion. The capability to determine yield and time interval, as minimum diagnostics, lay in the AEC Laboratory Task Units. The logistics effort for accomplishing these purposes, while in general military, had been assigned to the Laboratories and the Laboratories' hands were completely full with their own jobs. Thus, when Ogle talked to the Task Unit Commanders responsible for the AEC diagnostic system, there was no great enthusiasm for helping. The obvious technique, of course, would be to use the C-130s and the array control C-121 from Christmas, positioning an air array at a safe distance from the intended burst point. If fireball pictures were needed, it would be a difficult job to arrange the proper camera pointing without tracking beacons, etc. Use of bhangmeters and electromagnetic time interval measurements would be simpler. The result was that while concepts were bandied about, no detailed diagnostic plan for the Atlas test had been developed by the Task Force organization prior to the resumption of testing.

It took the Air Force a little while to get the Atlas test program started. In mid-March 1962, apparently because of possible safety problems and because Johnston Island was too close to Vandenberg to allow the desired trajectory, they were considering starting tests in mid-1963 in order to have time for reasonable planning. At that same time, they were considering target areas near Wake and Taongi. However, they apparently also realized the nature of the political situation, and, by the end of March, were investigating the possibility of doing the shot as part of the 1962 series. By then there had been enough discussion with the Task Force and the other portions of the system for the Air Force to realize the desirability of a warhead destruct capability during powered flight. The possibility of installing such a destruct system, however, did not appear likely in the time available, and the Air Force Ballistic Systems Division (BSD) continued to fuss with the problem. By mid-April the concept was to use the Johnston Island danger area for the target zone, and AEC approval was being discussed.

The principal concerns were safety related. In order to reduce the probability of an inadvertent nuclear detonation to about 10^{-7}, the Air Force could incorporate an additional prearming system into the warhead. The major problem, however, was the possibility of spreading some of the Mark 49's Ex.(b)(3) [redacted] around Vandenberg AFB if the missile were to go awry during launch or the early stages of powered flight. On April 19 the Commission decided that they would wait for a recommendation by the Secretary of Defense before approving the test.

The Johnston Island Buildup

The decision to use Johnston Island led to an immediate need to visit the island in order to make detailed logistics and construction plans. However, in early December 1961 that was difficult because while we had been told to prepare, and the Task Force had been established and was being staffed, we were also told to keep everything quiet and, specifically, to keep the existence of the Task Force quiet. Consequently, the necessary arrangements were made through AFWSC and CINCPACAF. The

survey team left Hawaii for Johnston on December 13 and spent the 14th making a quick survey and preliminary layout. In a few days the party had grown and a special airlift was arranged. In addition to Starbird, Mustin, and Ogle there were other representatives: Pat Ryan, Marty Curran, and John Pollet of H&N; Hittidale and Arthur from Douglas; etc. A quick look at the island revealed many problems. The power system was in poor shape, as were the barracks; water supply was inadequate; etc. Nevertheless, the party quickly laid out the beginnings of an island facility, including tentative positions for hospital facilities and headquarters of the various organizations. In addition, the Task Force missile group and the Douglas representatives learned the difficulties of building a launch pad by March in order to be ready for a Thor certification shot on May 1.

Thus, by December 7 Starbird had sufficient basis to make a preliminary estimate for the JCS of all the forces required, including ships, aircraft, etc. Better estimates were made in a December 11 meeting in Washington:

a. Three LSDs in the forward area by May 1 to serve as launching platforms for instrumented sounding rockets and as instrument receiving ships.

b. Two destroyers in place by February 15 to function as weather stations making upper air observations, and approximately four destroyers or destroyer escorts in May to conduct surface surveillance patrol and act as instrument receiving platforms.

c. Four LSTs/ships in January and February to provide transport between Pearl Harbor and Johnston Island for the buildup-support role of Johnston Island.

d. Sixteen Navy aircraft by March 15 to conduct air surveillance and antisubmarine patrol in the open ocean and Johnston Island areas.

e. Approximately five C-135 aircraft for optical and photographic measurements.

f. RC-121 aircraft by March 1 for use as airborne control aircraft.

g. An additional C-130 for high-altitude diagnostics measurements.

h. Two U2s by May 15 for very high-altitude weather photography.

i. Ten WB-50s for weather reconnaissance.

j. A VC-121 by February 15 as a transport aircraft for the Commander and distinguished personnel.

k. Three C-54s by March 1 for documentary photography.

A number of other aircraft and ships were mentioned to support separate experiments, and even a small boat pool was mentioned.

By the third week in December 1961 the DMA authorized ALOO to direct H&N to begin hiring personnel at a high rate, and the Task Force began negotiations with PACAF to take control of Johnston Island. H&N was to supply the support facilities and the AEC would be reimbursed for non-AEC users. The proposed JTF-8 Headquarters was on Ford Island because of the open sea operation, and work had already started in

designing the rehabilitation necessary there. Other moves started in that same week; design for rehabilitation of the barracks on Johnston Island; modification of the MATS freight terminal to take care of the increased load; modifications of both Hickam and Barbers Point to accommodate the increased activity; moves toward getting Douglas started on a program of inspection, checkout, and packaging of the Thor and working with H&N for the design of the necessary construction work on the Thor pad; steps to authorize the proposed test firing of the Thor at Vandenberg; appointment of a military commander to push the Thor effort; authorization for H&N to move onto Johnston Island on January 3; and transport of supplies to Johnston Island by December 26 so H&N would have necessary material to begin work.

Security classification raised its ugly head. The contractor personnel to be moved onto Johnston Island had to have Ex.(b)(1) [redacted] security clearance. A cover story had to be prepared to hide the increased H&N activity, both in Hawaii and Johnston Island, and a plan was prepared for dealing with the Hawaiian authorities in case of a leak.

An almost continuous series of meetings was held in the last two weeks of December and the early part of January among all of the participants to define the operational concept, the construction requirements, the logistic requirements, etc. The question of aircraft was a serious one. Both LRL and LASL wanted to instrument aircraft (preferably C-135s) for optical observations of the high-altitude shots, and DASA and AFSWC wished to do the same thing (and, of course, felt that they had priority on use of the aircraft). A series of discussions among the Laboratories, Field Command, and AFSWC in late December and early January tried to settle this problem. At the same time discussions began with the FAA to establish control of Pacific air routes during shot time to prevent hazard to commercial aircraft. During meetings near the end of the year the following arrangements were formalized:

a. Sandia would deal directly with Douglas and AFSSD on the problems of mating the capsule containing the test device to the Thor and all the electronic problems related to firing, fusing, safety, etc.

b. Colonel E. A. Meyer was assigned as AFSC project officer for the high-altitude program.

c. Douglas would immediately begin work to define Thor trajectories, including the effects of winds on the accuracy of warhead positioning.

d. The Task Force would arrange for range tracking.

e. As a deputy to Ogle, Colonel Rod Ray would be responsible for all weapon carrier missile problems.

f. DASA would review their need for nose pods.

g. Communications needs would be coordinated directly with Colonel W. A. Randall of JTF-8/J-5 or Sam Howell of H&N.

h. Shipping requirements and weapon movements should be coordinated with Captain George Waite of Task Force J-4.

Late in December 1961 DASA Field Command issued a tentative weapons effects program for the DOD portions of the tests, listing the purposes of the program, the information sought, the types of measurements to be made, the tentative project

agencies and project officers, and estimated costs. The plan included the two shots, Starfish and Bluegill. Some of the purposes given were as follows:

Ex.(b)(3)

[redacted]

Ex.(b)(3)

[redacted]

Ex.(b)(3)

[redacted]

Four main programs were outlined, each containing several projects. The programs were blast and shock measurements, nuclear radiation and effects, electromagnetic phenomena, and thermal radiation effects.

Among the techniques to be used were fireball photography from the ground and the air; neutron threshold and gamma detectors in the pods; neutron and gamma detectors in small rockets; observation of transient electromagnetic effects on various radar and communication systems; radio transmitters to be carried on small rockets to the appropriate place with respect to the fireball for ground observation of transmission; spectrometers and various flux rate meters and particle collectors on small rockets; resonance scattering measurements; observation of magnetic field changes and motion of the debris by small rockets; observation of cosmic noise attenuation; observation of radar echoes, clutter, and scintillation using equipment mounted on ships; ionospheric observations from a KC-135; satellite observations of trapped electrons, magnetic field fluctuations, fission fragments, synchrotron noise, and x-radiation; scanning spectrometers and black body bolometers; high-speed streak and framing cameras; lower-speed technical photography; total thermal energy versus time; observation of the effects on recoverable pods due to debris and heat using impulse and ablation gauges, calorimeters, accelerometers, etc.; x-ray flux and spectrum measurements from detectors on small rockets and satellites; indenter gauges to measure the total momentum of particles; and others.

Sandia designed a "mylar sail" to sample the debris from the high-altitude shots. It was to be raised to high altitude by a small rocket, deploying a large sheet of mylar at 80 kilometers during ascent. The "sail" would then sample from 100 kilometers to 220 kilometers altitude, at which altitude the sail would be retracted into the nose cone and sealed. Following splashdown of the nose cone, the system would be recovered from the water. The nose cone was built to float and had the appropriate radio aids in it for signaling its location.

During the last week of the year the first increment of Holmes & Narver

construction personnel arrived on Johnston Island and the first shipment of 1,000 tons of construction equipment and supplies departed Pearl Harbor by barge en route to Johnston Island. During the first week of January Brigadier General Eugene A. Salet, U.S. Army, arrived in Washington for briefings before assuming his duties as Commander of Johnston Island.

By the second week of January 1962 arrangements had been made for Sandia to use the Barking Sands facility on Kauai for their small rocket program; negotiations were essentially complete for transferring control of Johnston Island to JTF-8; and Field Command DASA was prepared to send a group of people on a tour of the Pacific to arrange sites for the appropriate instrumentation. Some of the sites selected in addition to Johnston Island and Christmas Island were Oahu, Maui, Kauai, Hawaii, French Frigate Shoals, Midway, Wake, Okinawa, Kwajalein, Palmyra, Canton, Fiji, Samoa, Tongatapu, Rarotonga, Adak, Fairbanks, and Palo Alto.

Other important parts of the system had also been defined. Dan Rex had recommended islands to be used for weather observations and necessary use agreements were underway. The safety system was started. At Ogle's suggestion Starbird selected Gordon Jacks to be responsible for the rad-safe organization.

A most important meeting took place on January 9 among the AEC Laboratories and Field Command DASA during which it was decided that LASL would procure [redacted]

Ex.(b)(3)

Sandia agreed to attempt a real-time presentation of the radar tracking data they were acquiring for their own purposes, and the Cubic Corporation, under contract to DASA, also agreed to provide additional tracking data (as a backup) from a transponder installed in the Thor.

On that same day, at General Samuel's urging, Systems Command established Task Group 8.4 (provisional) at Kirtland Air Force Base. In the first week of January the AEC assigned the nickname "Dominic" to the possible forthcoming atmospheric operation in the Pacific. The Air Force also changed their support nickname from Blue Straw to Staghound.

Field Command and Sandia followed up quickly on the question of a beacon on the reentry vehicles and concluded by January 11 that Cubic could not put the transponder in the vehicles; however, a transponder in one of the pods would be acceptable.

On January 12 Starbird formalized the establishment of Task Group 8.3 (Navy), Task Group 8.4 (Air Force), Task Group 8.5 (AEC Support Task Group), and Task Group 8.6 (Johnston Island Command). He also formalized the first Task Units as 8.1.5 (Space Systems Division), and 8.1.6 (EG&G).

One of the persistent troubles started about this time. The McMillan Committee was not pleased with the pods that had been suggested by AFSWC and DASA to obtain ablation data, etc., but wanted to test a genuine reentry vehicle. They thus proposed that an R&D version of the Minuteman Mark 5 reentry vehicle be used instead of the pods and asked for an investigation of this concept in mid-January. This uncertainty persisted throughout the entire planning period. By the time it came to a head, Douglas had run wind tunnel tests, etc., to convince themselves that the pods would not do anything disastrous to the aerodynamics of the Thor, but there was no way to achieve that same satisfaction for the mock RVs.

Another major change was made in mid-January. The initial agreement with Douglas and SSD had been that there would be an initial certification shot of the Thor fired from Vandenberg AFB in March. From discussions early in January it became clear that the missile trajectory should be the same for all tests, the different altitudes being achieved by firing the warhead at different times on the missile descent path. Consequently, it was desirable that the certification shot have essentially the same trajectory. Unfortunately, for safety reasons, that trajectory was

not acceptable for launch from Vandenberg. Consequently, in mid-January the decision was made to fire the certification shot from Johnston Island itself on or about May 1, essentially as soon as the pad and the firing system could be ready. At the same time, the Pacific Missile Range agreed to provide the range safety service for the Johnston Island operations, using a range safety ship anchored in the Johnston Island lagoon. The fallout prediction unit was also established at this time as a result of a request by Starbird to John Foster of Livermore for Vay Shelton's services. It was Shelton's responsibility to put together that prediction unit.

On January 17, 1962, an agreement was signed by the AEC, the Task Force, and PACAF in which PACAF agreed to minimize their work on the island for the duration of Dominic. JTF-8 took control of the island on January 22.

The AEC high-altitude effort also began to take form during the early part of January. That effort consisted of several parts. First were those measurements to be conducted on Urraca as part of the development of a deep space diagnostic capability. All three Laboratories participated in that effort, but LASL was perhaps a little more heavily involved since they had gotten an earlier start and also because of their interest in the deep space problem during the moratorium and the growth of Vela Hotel and Vela Sierra. Thus, LASL P-Division, under Taschek and others, in conjunction with Sandia, began to develop detailed plans for measuring all the device outputs using instrumented rockets that would be launched by Sandia from Kauai and Point Arguello in California. They would also use Vela Sierra (surface-based) equipment deployed by AFTAC, and, if it could be arranged, Vela Hotel satellite-based instrumentation.

LASL began to define an extensive photography program with the help of EG&G. That photography would be done from a major station on Johnston Island, from Mt. Haleakala on Maui, and from a C-135 flying in the appropriate position with respect to the shot. Sandia also began planning not only for support of the other AEC laboratories, but for some Johnston Island-based photography of its own. LRL, slightly later, in conjunction with Sandia, developed somewhat different experiments aimed mainly toward the observation of x-ray and neutron outputs from the very high-altitude shots and toward deep space diagnostics. Knowing that Urraca was somewhat uncertain, all three Laboratories designed these experiments so they could also be used on Starfish and, to a certain extent, on Bluegill. By late January the concepts for these experiments were in hand, and over the next three months the effort was directed toward building the equipment, doing the construction, and moving the equipment into the field.

In conjunction with their long experience on fireball phenomena, LASL was able at that time to carry out detailed calculations of the expected device outputs and the expected interaction with the atmosphere and geomagnetic field. By the later part of the planning period these efforts had resulted in sufficiently detailed predictions that they were essential to the AEC experimenters and they were also of great assistance to Department of Defense efforts.

The instrumentation to be launched from Point Arguello was designed to measure in essentially the same intensity ranges as might be used in diagnostic methods in deep space. The closer instruments launched from Kauai and Johnston would, in general, see much higher intensities. Thus, LASL and Sandia attempted to get Journeymen rockets for firing from Point Arguello. This was eventually accomplished by a letter from a high level in the AEC to Mr. Seamans, the NASA Administrator. Vandenberg AFB agreed that the missile could be launched from Point Arguello. In early March LASL switched to the use of Astrobee 1500 rockets. Sandia would provide the Astrobees for Urraca.

Samuel and Wignall had a difficult time with the Air Force in obtaining the proper number of C-135 aircraft to be modified for both the DOD and the AEC, the Air

Force supply being very tight at the time. Initially, LASL had intended to use a C-130 for the high-altitude photography, but in early January Westervelt concluded that it would not have the proper characteristics and therefore requested a C-135. (The 130 had too much vibration and could not fly above the clouds expected.) Livermore made a similar request. On the other hand, DASA wanted two more such aircraft for similar modification, in addition to the already modified Air Force Cambridge Research Lab C-135. AFSWC got the possible users together in mid-January and concluded that LASL did have a valid requirement for the C-135. At that meeting LRL withdrew their request for the aircraft, believing that sufficient coverage would be accomplished by the other organizations. It was pointed out, however, that if AFTAC were to join the effort a fifth plane would be needed since there would not be room on any of the other aircraft for their experiments. In late January Systems Command agreed to furnish the LASL KC-135 aircraft for modification in the Big Safari (General Dynamics/Air Force Logistics Command (AFLC)) project to a configuration to be determined by AFLC and LASL. The plane would be delivered by SAC to AFLC Plant 4 at Ft. Worth (General Dynamics) on Janaury 29. SAC would also provide the crew and maintenance personnel. After modification the aircraft would be needed at Kirtland for about two weeks early in April before deployment to Hickam for participation in the Tiger Fish dry run (Thor launch). General Samuel thought he had arranged for a recent model KC-135 for LASL, but when the plane was delivered it turned out to be a vintage 1955 aircraft (Tail No. 553136) which had not been maintained in accordance with USAF tech orders. The time needed to comply forced a 23-day delay in installation of LASL instrumentation, making it unclear whether participation in the certification shot of May 1 could be achieved unless some of the tech orders were waived. This possibility was not pleasing to LASL technical people who would not care to fly in an "unsafe" plane. Hoerlin recommended that another aircraft be obtained immediately. However, after General Samuel looked into it, the answer came back from Air Force Logistics Command at Wright-Patterson AFB that they were planning to put in a maximum effort, that in no case would flight safety be compromised, and that they expected to have the plane ready at the desired time. This action satisfied CJTF-8, and LASL calmed down a bit. By March 7, with hard work, the aircraft seemed to be approximately on schedule and LASL could even offer AFTAC space in 553136 for certain of their gear. On March 14 Hoerlin thought the plane would be at Kirtland by March 31 and would be able to conduct four check-out flights and leave for overseas on April 19 or 20. However, two days later, information seemed to imply an almost 20-day delay, which would mean missing the certification, and Hoerlin so notified General Samuel, seeking assistance to get the proper support for his aircraft. He made it clear that in the first place he could not afford to miss the certification flight, and in the second place he wanted to participate in the early Christmas Island LASL detonations as a further shakedown. Apparently the pressure helped; by April 17 the LASL KC-135 was scheduled to depart Kirtland on April 21, and on April 23 Hoerlin was on Johnston Island, ready for the rehearsal of the certification shot, then to be held on April 26.

DASA had similar problems with their two KC-135s which were to be modified by the Air Force Office of Aerospace Research. Throughout February 1962 JTF-8, TG 8.4, TU 8.1.3 (WET), and SAC were trying to speed up the modifications to those aircraft.

Ex.(b)(1)

[redacted]

Ex.(b)(1)

[redacted]

However, for the fixed installations, AFTAC did have to cooperate and for many of their projects "piggybacked" on the WET programs. TU 8.4.1, in February, was commanded by Lieutenant Colonel D. B. Herbert, with alternates Major K. Mendenhall and Major J. R. Adams. They informed the Task Force they would conduct some 12 scientific projects using 30 stations established in Hawaii, Palmyra, Johnston, Midway, Maui, Kauai, Fanning, Kwajalein, Wake, Tutuila, Okinawa, Guam, and Penrhyn. AFTAC cooperated closely with the AEC Laboratories, particularly LASL, in the design of experiments to advance their technical capability for observation of foreign detonations. They instrumented to observe seismic signals from the high-altitude detonations, remote air pressure changes, remote electromagnetic signals, changes in the ionization of the air, etc. By putting some of their gear on the LASL C-135 they also could observe the Christmas Island detonations from appreciable distances, although it remained for LASL scientists to develop successful techniques for long-range observations.

LASL had yet another traumatic experience, this one with respect to their optical station on Mt. Haleakala. There was no housing at the top of the 11,000 foot mountain, and the drive down to the ocean to the existing hotels was long and, to a certain extent, hazardous, the road near the top being very narrow and having many hairpin turns. The Park Service was just closing up an old installation called the Silversword Inn several miles from the top of Mt. Haleakala, and LASL initiated steps to borrow that inn for housing for the duration of the operation. The Task Force, H&N, and AEC all got into the act; the Park Service was reluctant, but after a month or so of prodding finally agreed, and by early March the LASL personnel were ensconced not far from the top of the mountain.

The arguments concerning pods and RVs continued through the first part of 1962. Since the McMillan Committee had recommended putting the RVs on Starfish, and DASA thought it was already too late to do that, Booth made a clever suggestion in mid-January, that the RVs be flown on the proposed AEC high-altitude shot, Urraca. He continued along that vein, and in early February the pods for Starfish and Bluegill were defined as identical in total weight, external configuration, and center of gravity. Each set would have a total weight (3 pods) of 1,200 pounds. The pods would be positioned at different distances from the burst, ranging from 2,500 feet up to 14 kilometers. However, the AEC aim was to get Urraca as high as possible. When Douglas finished calculations of the initial trajectories in early February the highest possible altitude turned out to be 1,300 kilometers. Since the height would be appreciably lower carrying pods or RVs, the AEC made it clear that they did not want pods on Urraca.

Early in February, DASA decided on the division of responsibility for each of the three pods on the three shots Tiger Fish, Starfish, and Bluegill. One was assigned to the Army's Ballistics Research Laboratory (Aberdeen), one to the Nuclear Defense Laboratory (Army Chemical Center, Maryland), and one to AFSWC and ASD (Air Force Aeronautical Systems Division).

The McMillan Committee continued to press for RVs. Early in January they had met in California with representatives of SSD, AFSWC, Douglas, Convair, and Avco (the manufacturers of the Mark 5 reentry vehicle). It was clear at that meeting that Douglas could not guarantee, without further wind tunnel tests, that Mark 5 reentry vehicles placed on the Thor (instead of the pods) would allow satisfactory operation of the Thor. Furthermore, DASA and their experimenters felt fairly strongly about having some of the pod experiments on Starfish, and were unwilling to have all three

positions taken by the RVs. As a result it was concluded that Douglas, in making the internal structural modifications to the Thor necessary to carry the pods, should also arrange for attachment hardware so that Starfish could take RVs, if that was decided, or a mixture of RVs and pods. If a mixture were possible, the RVs would then be positioned at 10 and 14 kilometers from the burst and the pod at 7 1/2 kilometers. At the same time it was noted that Convair was having problems developing the recovery package for the pods in time for the May 15 date of Starfish. Noting that Urraca would not carry pods and, hence, would not have a recovery problem, the McMillan Committee recommended that scheduling be changed so as to do Urraca on May 15, Bluegill on June 1, and Starfish on June 15, thus allowing time for the pod recovery package to be developed and for Avco to develop the complete RV system and recovery package. Later in the month the decision was made to build both pods and RVs and put the appropriate mounting attachments on the Starfish Thor. Douglas made it clear that they were very uncertain whether any method could be devised for carrying a mixed load. By mid-April Douglas had carried out wind tunnel tests showing that the mixed load would cause the missile to be unstable. They were working on a design to fix the instability, but had little confidence that a reliable design could be implemented in time for the June 15 firing. The conclusion was reached to continue with both RVs and pods and try to decide what to fly two weeks before the shot date, or about June 1.

The AEC Laboratories initially did not object to the May 15 date for Urraca; in fact, they were happy to get it into the schedule at all, so throughout March the change proposed by the McMillan Committee was accepted. However, Kiley, who was responsible for the DOD effort, objected on the basis that Starfish and Bluegill were of higher priority than Urraca, and, therefore, the scheduling should be done in such a manner as to maximize the probability of the successful launching and obtaining of maximum data on Starfish and Bluegill prior to June 30 (since the President was going to terminate testing on June 30). He also pointed out that this would allow the DASA projects to participate on Urraca, having completed their efforts on Starfish and Bluegill, and that this was of appreciable interest to the Department of Defense.

In early March Starbird began to be nervous about all these proposed changes in schedules, in pods, etc., and instructed the SSD Task Unit (8.1.5) not to make any further changes in weight, configuration, and trajectory without his specific direction.

Also in early March Field Command began to discuss the time of day for the detonations, noting that they needed at least one hour of darkness at the burst point for photographic documentation, but they needed daylight for recovery of the pods and RVs. They were not concerned about the lunar background. However, Hoerlin of LASL was, and in mid-March he pointed out that May 15 was a particularly bad time for Urraca since there would be a full moon within 5 to 20 degrees of its burst location, as seen from the aircraft and Maui. He also pointed out that Starfish had similar problems on its scheduled date of June 15, and requested that we have another look at the schedule. LASL also began to get in trouble because of the late scheduled delivery for magnetic tape recorders to be used in their rocket instrument packages. Taking all these problems into account, Shuster conferred with the Laboratories and DASA, and, in early April, requested that the schedule be changed to have Bluegill on June 1, Starfish on June 15, and Urraca on July 1. Starbird checked the point with his deputies and accepted the proposed change.

In the early months of 1962 problems arose with the orientation of the RVs carrying the warheads. The Atlas RV chosen by Sandia much earlier used a very heavy copper heat sink to assist in reentry. It was quickly realized that the large mass of copper would affect the device outputs and appreciably change the phenomena. These

effects would be especially serious on the higher-altitude shots Starfish and Urraca, which would not engulf large masses of air in the early part of their expansion, but were not so serious on the comparatively low-altitude Bluegill. [redacted]

Ex.(b)(3)

As the early months of 1962 went by Ogle asked several people to help him on the multitudinous detailed safety problems that had come up day by day. One at a time, the various people were asked to help in given fields and the conglomeration of such people eventually became known as the Hazard Evaluation Group. Although they were never formally organized during Dominic, the membership kept changing as people had to move around the Pacific for different efforts. Their work would have been easier had they been recognized formally.

In December 1961 Starbird had become quite worried about the safety of the airdrops and had appointed an ad hoc safety committee to review in detail the drop procedures, firing and fusing, etc. In late January AFSWC noted the existence of this committee and inquired if anyone was worrying about the same kind of problem on the high-altitude shots. As a result, in mid-February, Rod Ray, with Starbird's concurrence, set up the Fishbowl Safety Committee to review the fusing, firing, range safety, etc., for the high-altitude shots.

In late January Ogle asked the Laboratories whether their devices would go critical if they fell in the water, and how did the result change at great depth. After some time, the conclusion was that the devices would not go critical.

As mentioned elsewhere, in January and February Van Dorn of Scripps was funded by the AEC to assist the Task Force in water wave prediction and also to instrument a number of spots in the Hawaiian Islands to measure any tsunami formed. His work was continually watched by Ken Olsen of LASL. In late March Starbird appointed Lieutenant Commander P. Kwart as his Project Officer for Range Safety of the Thor launches from Johnston Island. A Range Safety Officer would have authority to destroy a missile, but any warhead destruct command would come directly from the Task Force in the Operations Center. In March it was decided to store the extra rocket motors on Sand Island, part of Johnston Atoll, rather than on Johnston itself. The motors could not be stored in Hawaii because they couldn't be transported to Johnston soon enough after one shot to prepare for the next shot on the required schedule.

On March 15 Starbird informed TG 8.4 that they had the EOD (Emergency Ordnance Disposal) responsibilities for the whole Task Force, and that they should establish appropriate capabilities at Barbers Point, Christmas Island, and Johnston Island during the operation.

In mid-March the question of the birds on Sand Island of Johnston Atoll was considered. During Hardtack great efforts had been made to prevent damage to the birds, including building a water spray system and laying down an artificial smoke layer over the island. However, since the Dominic shots were to be appreciably smaller than the Hardtack devices, and taking into account the Hardtack experience, it was concluded that no protective measures needed to be taken for Dominic.

However, the greatest problem with the expected effects of the high-altitude shots was that of possible eyeburn if the detonation should be viewed directly. Substantial work had been done on this problem during Hardtack and it was because of this hazard that the Hardtack high-altitude shots had been moved from Bikini to Johnston. Dominic presented a new problem, since these detonations would expand in what amounted to a vacuum. The approach adopted had two phases: one was detailed calculations by LASL and DASA on the brightness and light flux to be expected, and the other, funded by DASA, was discussions of the characteristics of the human eye with respect to burns, largely using the data of Dr. W. T. Ham. On March 16 Hoerlin commented on the Starfish assessment:

> A rather shaky extrapolation of Ham's data indicates that for small image sizes, burn threshold is near one calorie per square centimeter. Consequently, use of dark glasses in danger area must be recommended. The Hawaiian Islands appear safe. However, the more competent opinion of medical biological scientists is solicited. . . . After 100 microseconds, the brightness of debris drops drastically and its contribution can be neglected in view of the somewhat generous integrations of early dose.

Debates on this problem, which continued almost throughout the whole operation, determined the size of the danger area in some cases. The hazard to people in high-flying aircraft was such that for some shots the danger area at aircraft altitude extended beyond the Hawaiian Islands. At the end of March Ogle concluded that the Ex.(b)(3) shot at 11,000 feet (Frigate Bird) should be conducted so that no uncontrolled observers were within 150 statute miles. For Bluegill, some 470 nautical miles would be the required stand-off distance. Starfish and Urraca appeared to be safe for viewing from Hawaii, but between Hawaii and Johnston people on the water should be required to wear dark glasses.

On Johnston Island itself, assessment of potential hazards led to the conclusion that in order to protect people from rocket misfiring no one should be closer than 2,500 feet from the Thor launcher, and those people either had to be in underground shelters or in specially designed facilities. Only essential personnel would be allowed within 1,000 feet of any small rocket launchers, but they could be no closer than 500 feet and had to be behind suitable sandbag barricades at launch time.

Arrangements by the State Department, JTF-8, etc. continued during the first four months of 1962 to obtain land in many foreign possessions and many small islands for locating both experiments and weather stations. Equipment was prepared and shipped to the islands as soon as permission was obtained.

On March 17 arrangements were made to set up a special weekly flight from Hickam to Palmyra, Canton, Viti Levu, Tongatapu, Tutuila, Rarotonga, Tongareva, and back to Hickam. Another weekly flight was arranged from Hickam to Kauai, Niihau, Maui, French Frigate Shoals, and back to Hickam.

While the formation of the Task Force was publicly announced on March 2, some restrictions were maintained for the next two weeks, but on March 17 Starbird informed the Task Force Units that they would now change their cover stories and admit that they were engaged in authorized preparations to resume nuclear testing in the atmosphere, should it become necessary.

By March 26 there were 1,000 people on Johnston Island. The users had occupied the missile launch facilities, arrangements had been made to tie the Range Tracker to the dock, and plans were being made for helicopter evacuation of personnel to an aircraft carrier before shot time. On the negative side, the sewage system was overloaded and serious problems existed with the sanitation facilities, the distillation plant was having troubles providing enough water, and the Island was crowded. Starbird requested that no more projects be added.

On April 6 Joe Sanders replaced Reeves as Commander of Task Group 8.5. Requirements continued to be added. In mid-February, because of the problems experienced on Hardtack in maintaining communications with Hawaii immediately after the shot, the Task Force requested that several aircraft (preferably B-47s) be made available for direct line-of-sight radio relay between Johnston and Hawaii in the event of high-frequency blackout. On March 8 the need for still another aircraft was noted to help calibrate the Cubic Corporation's tracking equipment on Johnston; it would carry a beacon and fly around Johnston.

As shot time approached other problems arose. In late March Shuster, who had been designated acting Scientific Deputy on Johnston Island, was asked to compile a complete "go-no-go" list for each experiment connected with the high-altitude shots, based on inputs from each Task Unit, and have it ready no later than April 5. The list was not quite ready then, and, of course, was still being debated when we were told to start testing.

On April 12, with the nation somewhat disturbed at the size of the danger areas, especially at aircraft altitudes, the Commission discussed the question. The FAA had agreed that they could route aircraft around the danger areas, given two days notice, but they would prefer more. The uncertainty of the weather made a longer notice somewhat questionable. It was agreed that a four-day notice would be given to FAA along with a similar warning to the Hawaiian officials. Other points came up in this same meeting; in particular the question of U.S. citizens attempting to interfere with the operation. It was agreed to issue a regulation which would allow the Commission to seek an injunction if someone tried to enter the danger area.

Of somewhat more importance at that meeting was the discussion of visits by U.S. and non-U.S. VIP observers to Christmas and Johnston Islands. Starbird felt that "It would be entirely wrong to have non-U.S. personnel at the Johnston experiments. Not only are the phenomena awe inspiring, but it would be almost impossible for us to enforce the necessary classification control aboard the evacuation ship from which they would view the shot." However, U.S. VIPs' trips were arranged for late in April and late in June on Johnston and late in May for Christmas Island.

By April 24 pressure from the McMillan Committee and DASA was already resulting in a move to add to the number of shots for the high-altitude portion of Dominic. Kingfish was being planned and DASA was beginning to make plans for the backup Thors.

By April the Spain Committee's instrumentation chart for Dominic, including just the listing for the projects with a brief description, was 60 pages long.

By April 24, although the date for Tigerfish was near, there were still problems with the pods. The Tigerfish dry run was scheduled for the 26th, the word was out that additional events might be added to the high-altitude series, the long-range countdown system was now transmitting half-hour practice runs twice daily, and the island was ready for the President's announcement.

The Resumption of Testing

On April 5, 1962, Starbird had declared the beginning of the operational period, at which time, the JCS had noted, he would report directly to them rather than through DASA. On April 24 Starbird was told by Betts to go ahead. It is not the intent of this history to give all the details of the operations on Christmas Island, etc., but some of the major points will be discussed. When the operation began we were on one-day notice for the Christmas Island shots, were ready to do the high-altitude calibration shot Tigerfish on May 1, were intending to do the Polaris system test shot on May 5, were performing rehearsals of the ASROC systems test, and were still arguing about the Atlas systems test.

The Christmas Island Operation

The Christmas Island operation went smoothly, though not without technical problems. In the first month of the operation 12 medium- or large-yield devices were fired and in the 78 days of the operation 24 shots were fired. The operation lasted one week longer than had been planned in mid-April, but four more shots were fired than had been planned in April. [redacted] There were, of course, operational and, as noted, technical problems. The organization worked extremely hard on the first 12 shots and complained bitterly when things slowed down in late May because of a lack of devices to fire. The people on the island concerned solely with Christmas Island operations nevertheless were pleased and, toward the middle of the operation, comparatively relaxed. However, the senior Task Force staff who also had to worry about four other operations were rather harried.

Several lessons were learned, and the first one came very hard. Ogle and Aamodt agreed to fire the first shot in a cloud and, consequently, lost the fireball data. That taught us to be more careful, and a judgment system to observe the clouds and determine when a hole was coming by was quickly set up using a crew of several people at the forward A Site and using data from the B-50 weather airplane flying upwind. A detonation in clouds did not happen again, but after about three weeks of firing, LASL raised the height of burst to get above the low level clouds. [redacted]

Another technical lesson was learned early in the operation. Fireball measurements from the C-130s were not worth the film they were printed on. There were all sorts of troubles, but the major ones were with the distance measuring equipment. By the time the operation was about half over, good data were obtained intermittently, and the reason for the problems began to be clear. Thus, by the end of the Christmas

operation, the C-130s were turning into moderately useful tools and the technical organization knew what to do to make them better.

At a March 28, 1962, briefing of the Atomic Energy Commission by the Joint Task Force, Ted Parsons had explained the details of the B-52 operation. The B-52 planes would depart from Barbers Point on Oahu, fly to, but not over, Christmas Island and proceed south of the island into a 16-minute racetrack pattern. The aircraft would then proceed on four test runs to ensure that its course remained within a 6-degree cone of the intended area of detonation. The B-52 would receive the final signal to release at minus nine minutes; at this point, the manual bomb rack would be unlocked. At minus one minute, the device would be armed and the bomb bays opened. Either the arming of the device or the unlocking of the manual release rack would be delayed until at most one minute prior to drop. This precaution was necessary because a large portion of the experimental team was at A Site, which had been placed as close to the detonation as was safe from the point of view of blast and thermal radiation. Parsons noted that each test would have three primary means of control, any one of which could abort the mission. The first control required that the bombing aircraft remain within a 6-degree cone on its final racetrack run, as determined by its own radar. The second means of control was at the Air Operations Center (AOC) located on Christmas Island, which also monitored the path of the plane to ensure that it remained within its proper run (by this, Parsons meant the information supplied from the C-121 control aircraft to the AOC). Finally, the Sandia Corporation had established an independent radar network at another location on the island. Each of these systems was, in theory, capable of halting the countdown. The difficulty was that the Sandia system initially was not capable of halting the countdown, both for administrative and technical reasons. The technical reason, at least for a while, was that proper communications with A Site were not possible. The administrative reason was that the Air Force wanted to control their operation and did not want to depend upon a civilian system for safety considerations. However, that attitude disappeared very early when the bomber, on one of its early orbits, lined up on A Site instead of the target. There was a great amount of screaming from the people in A Site and things were straightened out quickly, but from then on the Sandia radar was an integral part of the safety system.

Because A Site was so close to the explosion, the people there were required to wear long-sleeved shirts and/or cover themselves with white sheets if they were to be outside at shot time. The thermal radiation had been carefully estimated and found to be such that it might occasionally be slightly painful, but would not cause serious burns. On some shots the temperature inside the sheet got fairly high, but no one was hurt from this effect in the entire operation. Furthermore, there was no serious damage to equipment at A Site from blast, although on a few shots the somewhat more flimsy structures at the JOC were shaken up pretty badly.

The natives, however, were not quite so hardened as the Laboratory people, and as the shots went on some of them began to be a little frightened. Early in May a number of the native wives had approached the District Commissioner, expressing a desire to be evacuated with their families to Fanning Island. AVM McKinley and the Commissioner met with the groups and explained that there was no cause for alarm. Some of the natives could not exactly define their difficulties. Some were basically afraid and others indicated that the early rising and tensions during the countdown upset them and their children. Ex.(b)(1) [redacted] Ex.(b)(1) [redacted] Consequently, the Task Force arranged that those who wished could be taken aboard the LSD Cabildo, either the night before, if the shot was to be very early in the morning, or early in the morning if the shot was to be later in the morning. Aboard ship they were shown a movie and given tea and bread, and they were returned to the island after the shot. In general, about one-half of

the natives went aboard the ship and the rest remained ashore. Unfortunately, the U.K. authorities in Britain became aware of the problem and suggested to Gerry Johnson that the U.S. provide sealift for all the natives to Tarawa, but this never became necessary.

There also was a bit of a problem concerning the pay for the native male workers because we were disrupting their work. Ex.(b)(1) Ex.(b)(1) Starbird had been approached by McKinley with a suggestion that the U.S. pay the native male workers $3.60 per month dislocation allowance for the full three-month period of the Dominic series. Betts agreed that this could be paid out of AEC test funds.

The shots were occasionally delayed for weather, which, in the initial part of the operation, led to a great number of tired people. Fortunately for TG 8.4, there were backup crews for the B-52s. An example was Arkansas. On April 30 Ogle reported:

> We've tried Arkansas (LRL) twice now. Clouds prevented shot morning of 28. This morning, the 10,000- to 20,000-foot winds went over the island. The cumulus do occasionally reach to that altitude (i.e., 12,000 to 16,000 feet) and some rain might be expected from them. The prediction of rainout at London (Christmas) was uncertain, might be several roentgens. This is too early in the operation to do that. We will try again tomorrow.

In the earlier operations at Eniwetok there had been a great deal of difficulty with visiting VIPs. The problem was that these were all moderately high-level people, such as the Secretary of Defense, and they had to have a place to sleep, but there was no place to sleep on the island except in beds that, in principle, already belonged to some of the working people. Therefore, in those early operations the working people, usually rather high level in the organization, were moved out of their beds for the duration of the visit and were generally pretty bitter about it. Their view was that the visitors had nothing to do there particularly, were usually on some sort of a boondoggle, and were interfering with the work when such a move was required. (Of course, the visitors never requested this, but the Task Force hosts felt it necessary.) Because of this perennial problem, a new plush barracks had been built on Eniwetok for Hardtack just for visitors. This turned out to be a very satisfactory system. The visitors were happy and the staff was happy. Therefore, when we became aware early in 1962 that we were going to again be host to a great number of visitors, Ogle recounted this experience to Starbird and Starbird ordered a supply of house trailers (nicely built) for the visitors. The house trailers arrived in time and were set up and again the visitors and staff were happy.

Visitors would not have been happy, however, had they been required to eat in the mess hall. The problem of making pleasant eating surroundings at the Main Camp was never really solved, although it did get better toward the end of the operation. The basic trouble was simply that the facilities were too small for the number of people involved. However, the Navy had arranged for a very pleasant officers' mess which turned out to be very useful in hosting high-level visitors.

As noted earlier, the British made diagnostic measurements on our Christmas Island shots with our agreement. The Russians also made measurements with no formal agreement. During most of the operation a highly instrumented Russian ship stayed just outside the danger area, watching our shots. They would occasionally go to the Johnston area for those detonations. The Task Force and the Commission discussed the subject, but there was really nothing we could do about it except watch and keep fairly close by to make sure that they did not come within the danger area. During a visit to a number of the small island sites in the South Pacific, Starbird had a stopover in Fiji. While sitting in a small restaurant, he and his party observed

that the Russian ship Captain and his party were sitting at an adjacent table. Starbird did not want to chance an international incident, and therefore, did not have a discussion with the Captain. Luedecke, in discussing the problem of Russian presence at the tests with Gerry Johnson, said:

> A meeting of an ad hoc group on security of U.S. testing was held on March 30, and the results have been reported to you. In summary, discussions indicated that very little could be done at this date except to initiate certain contingency planning along military lines in case the U.S.S.R. takes overt steps to interfere with the Dominic series. It was also agreed that counterintelligence planning action should be initiated for future series beyond Dominic.

Another flap arose that is worth commenting on. In most previous Pacific operations at Eniwetok and Bikini there had been a strict rule against the use of private cameras. However, at Crossroads cameras were furnished to a great number of the personnel, and they were encouraged to take any pictures they wanted to, with the idea that out of that mass of film would come a good documentation of the operation. In actual fact most people are not good photographers, at least not with the equipment as it was in 1946, and almost all of the pictures were of no value. However, since they were practically all unclassified, they did serve as good mementos to the people involved in that operation. Remembering that, Ogle suggested to Starbird in early 1962 that we allow Task Force members on Christmas Island to use their own cameras to take pictures of anything they liked, just asking them not to take pictures of anything classified. Basically, the argument was that there was nothing classified, unless a document was copied or something of that sort. Starbird acceded to that request and for the buildup period at Christmas Island, and into the operation a little way, such private cameras were allowed. Unfortunately, there is always someone to spoil things, and, in this case, a picture of a detonation was sold to the Oakland Tribune Publishing Company and appeared in many of the Sunday newspaper editions on May 27, 1962. President Kennedy had a phobia about public exposure and specifically did not want to have pictures of bombs going off appearing in the newspapers, so the lid was clamped down immediately. The next day all private cameras were picked up on Christmas Island, to be held for later return, and all personnel were required to sign a certificate that they had turned in all nonauthorized cameras, film, and prints. Along with other directives to the members of JTG 8.4, Samuel stated:

> When the initial policy on cameras on Christmas Island was established, it was done so under the then existing criteria of what constituted classified and unclassified photography. These definitions have not changed. However, the sensitivity of the Christmas operation had not been anticipated. Unfortunately, because of a few of our people who, for whatever reason, will take into their own hands issues of this kind, it has been necessary to inflict on most of us considerable inconvenience to say the least. Unfortunately, we are forced to take positive steps to preclude the weaker among us from succumbing to the temptations which in the best judgment of those in authority can result in national disadvantage. I sincerely regret the circumstances which make this action necessary and assure you that we are doing everything possible to protect the equipment and photography.

In late June Carolyn Carlson, a physicist in the Livermore test division, wrote to President Kennedy complaining about the exclusion of women from participation in the test series. She noted Kennedy's numerous statements on nondiscrimination and concluded, "The current laboratory policy responding to the traditional military reluctance to treat trained women as professionals is unwarranted on the basis of either the ethical or the practical considerations involved." The letter was referred to Seaborg, who stated he would include the consideration of women in appropriate facilities in planning for future testing overseas.