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**THE LAST BIG BANG**  
**Austin D. McGuire**  
**R. A. Meade, ed.**

**Editor's Note**

As one of the very few people in the world to give the “go/no go” decision to detonate a nuclear device, Austin “Mac” McGuire holds a very special place in the history of both the Los Alamos National Laboratory and the world. As Commander of Joint Task Force Unit 8.1.1, on Christmas Island in the spring and summer of 1962, Mac directed the Los Alamos data collection efforts for twelve of the last atmospheric nuclear detonations conducted by the United States. Since data collection was at the heart of nuclear weapon testing, it fell to Mac to make the ultimate decision to detonate each test device. He calls his experience **THE LAST BIG BANG**, since these tests, part of Operation Dominic, were characterized by the dramatic displays of the heat, light, and sounds unique to atmospheric nuclear detonations – never, perhaps, to be witnessed again.



**Dominic – Chama**

## Author's Forward

In reading over what I wrote nearly fifty five years ago, I was jarred by the thought that things really have changed. The year 1962 was truly significant – we conducted our last series of atmospheric nuclear detonations and survived the Cuban missile crisis. In retrospect, I believe President John F. Kennedy saved our nation. Just before the Cuban crisis, the USSR ended the moratorium on nuclear testing. In response, Kennedy authorized the resumption of nuclear testing leading to my going to Christmas Island and participating in what I call ***The Last Big Bang***. Many of us at Los Alamos knew that the USSR had a massive number of battle tanks and wanted, most likely, to occupy Western Europe (such as happened with Czechoslovakia). Our concern was testing warheads that could, if required, defeat the USSR's tanks with “acceptable” collateral damage.

By 1962, both the US and the USSR had nuclear armed missiles in sufficient numbers to achieve mutually assured destruction (MAD). MAD, of course, became the rationale for keeping nuclear –tipped missiles in their silos. When the Cuban crisis erupted, our leading Air Force generals wanted to destroy the Cuban missile sites in what would have been an act of war. But, thankfully, Kennedy used diplomacy to defuse the situation. One has to wonder what other presidents such as Harry Truman or George Bush might have done in this situation.

J. Robert Oppenheimer, the director of Los Alamos during World War II, devoted a great deal of effort in his later years advocating for nuclear arms limitation. He believed strongly in international agreements to reduce or even abolish nuclear weapons. Although his detractors held him up to public disgrace, his supporters never wavered in their respect and admiration. Both Oppenheimer and his supporters were deeply depressed by the vehemence against arms limitation, a policy now widely supported. So now, in the age of the SALT and START treaties and with no further nuclear testing likely (except for North Korea), this document, I hope, will help illustrate the work that many of us did in service to our country. Written back in “the good old days” (formerly known as these trying times) for my family and a few good friends, I hope this personal account will be of some interest to those who carry on the work of Los Alamos.

## THE LAST BIG BANG

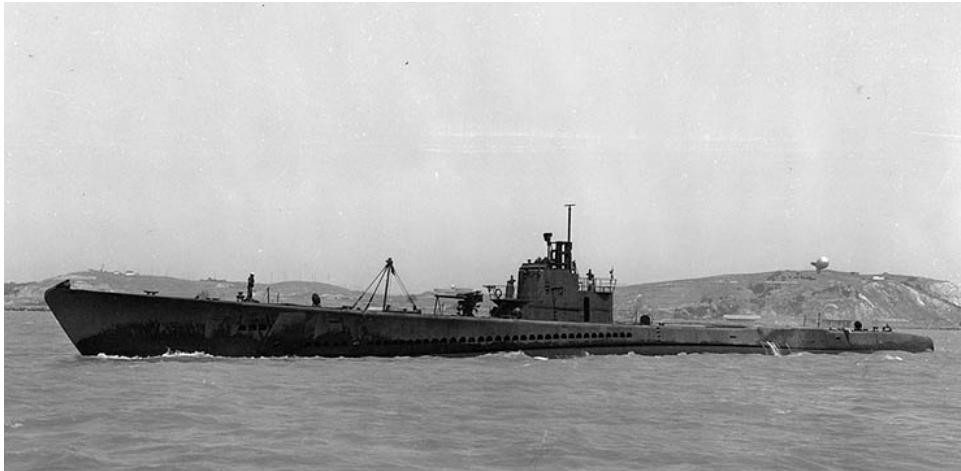
This is a story about the part I played in the last atmospheric test operation conducted by the United States – Operation Dominic. The events of my story were set in motion when the USSR ended the moratorium on testing that had been in effect since the fall of 1958. Not only did the Soviet Union break the moratorium, they also exploded the largest ever nuclear explosion – a 50 Megaton burst on October 30, 1961. In response, President Kennedy authorized the resumption of nuclear testing both at the Nevada Test Site and in the Pacific Ocean (Christmas and Johnston Islands). My story is most closely related to the twelve atmospheric tests conducted by Los Alamos in skies near Christmas Island.

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### Operation Dominic Los Alamos Christmas Island Shots

Test	Design Laboratory	Date	Yield (kt)
Adobe	LASL	04/25/1962	190
Aztec	LASL	04/27/1962	410
Questa	LASL	05/04/1962	670
Mesilla	LASL	05/09/1962	100
Swordfish	LASL	05/11/1962	low
Encino	LASL	05/12/1962	500
Nambe	LASL	05/27/1962	43
Alma	LASL	06/08/1962	782
Yeso	LASL	06/10/1962	3000
Rinconada	LASL	06/15/1962	800
Dulce	LASL	06/17/1962	52
Otowi	LASL	06/22/1962	81.5
Sunset	LASL	07/10/1962	1000
Chama	LASL	10/18/1962	1.59

First, a little bit about me. I graduated high school in 1943 and immediately joined the Naval Reserve. I was lucky to be given electronics training before being assigned to submarine service. I was even luckier in getting discharged after the war with only a minor hearing loss, the result of my duty as a member of the submarine's five-inch deck gun crew. After my discharge, I attended MIT and graduated with a Bachelor's degree in physics. I then moved to the University of Rochester and graduated with a doctorate in nuclear physics. While at Rochester, I married a woman that I grew to love more and more as the years passed by – Irene (Rene). Rene also received a graduate degree at Rochester – a PhT – “pushing husband through.” I could never have made it without her love and support. After graduation, I accepted a job at Los Alamos, arriving in 1954.



### **The USS Sturgeon – one of the submarines I served on.**

At Los Alamos, for a period of about two years, I conducted basic research. In 1956 I decided to broaden my professional horizon by seeking out a job involving applied physics.<sup>1</sup> This change also coincided with the birth of my daughter Tracy, a great event for me. My first practical or applied science job was to create a method of measuring a particular bundle of neutrons that would be emitted from Shot Koa of Operation Hardtack 1.<sup>2</sup> As a result of my work, I was invited to help conduct the actual experiment, which took place at Enewetak Atoll in the Marshall Islands.

My next project came about because Norris Bradbury, the Laboratory Director, asked the Physics Division (P) to conduct research not currently being carried out by LASL. Coincidentally, the discovery of a belt of intense ionizing radiation – the Van Allen Belt – by way of some rather unsophisticated instruments - gave me the idea of developing more sophisticated and sensitive instruments to better study this new discovery. My idea was accepted, and I developed instruments that were launched from Cape Canaveral and successfully collected much significant data.

About this time, the US and USSR negotiated a treaty that banned nuclear tests outside the Earth's atmosphere. The US Senate would not ratify the treaty until a reliable means of detecting an explosion in space could be installed. The Senate's concern, in the form of a resolution, was sent to the White House and the Pentagon. The White House, in turn, sent the resolution to the Atomic Energy Commission. The AEC posed the issue to Bradbury, who passed it on to P Division. Eventually the question was given to a number of the division's staff members, including me. I proposed and demonstrated the sensitivity of a specific type of radiation detector. I then recommended a detection system of three satellites, each housing a dozen of these detectors. One of the Laboratory's theoretical physicists calculated that my

<sup>1</sup> Among Mac's reports are: **K-SERIES X-RAYS FROM  $\pi$ -MESONIC ATOMS** (The Physical Review, 1955), **DETECTION OF THE FREE ANTINEUTRINO** (THE PHYSICAL REVIEW, 1960), **PROPOSED TECNIQUE FOR SURVEILANCE OF INITIATORS** (LA-01931), and **DESIGN STUDY FOR A 12-BEV CONSTANT-GRADIENT PROTON SYNCHROTRON** (LA-02102).

<sup>2</sup> KOA, detonated on May 12, 1958, had a yield of 1.37 megatons.

proposed satellite system could detect a one-megaton explosion out to a distance of one astronomical unit from earth. There was, of course, the question about how often a false alarm would occur, that is, a signal that looked like a bomb, but was caused by cosmic rays. I designed a mockup satellite, complete with a dozen detectors, that was lifted by balloon to the top of the atmosphere to measure the chance of a false alarm from cosmic rays. This experiment showed that my system could detect a one-megaton explosion occurring one astronomical unit distance from earth with a false alarm rate of one in one hundred years. As a result of this experiment I was invited to give a briefing at the Pentagon. My system was adopted and used. No explosions were ever detected.

Shortly after giving my Pentagon briefing, I transferred to the Laboratory's Field Test Division (J), where I began working on the Project Rover experimental nuclear reactors being tested at the Nevada Test Site (NTS). While working at the NTS, the Soviet Union resumed testing, ending the moratorium that had been in place since 1958. In response, President Kennedy ordered the AEC and the DOD to resume the United States' test program both in the Pacific and at the Nevada Test Site. Test operations in the Pacific were to be conducted at both Christmas and Johnston islands under the aegis of a time-honored institution – the Joint Task Force (JTF). The use of the JTF system originated in the Pacific Theater of World War II to coordinate and carry out combat operations involving all service branches. The success of the joint task force system led to its adoption for Operation Crossroads in 1946 and, subsequently, all nuclear tests carried out in the Pacific. Joint Task Force Eight (JTF-8), was created to carry out the Pacific tests under the codename Operation Dominic. William Ogle, one of LASL's longtime test directors, was appointed the Scientific Deputy of JTF-8. Bill was my immediate boss. The joint task force had a number of Task Units, including one for Los Alamos, JTF-8.1.1. Lee Aamodt was designated the Task Unit Commander.

Lee, however, was reluctant to accept the assignment on a long-term basis. Hence, Bill Ogle came to the NTS and asked me to be Lee's deputy with the understanding that I would take over as Task Unit Commander at some point. Although I was in the process of leaving the NTS, I was not interested in accepting the position and turned down Bill's offer. Shortly after I returned to Los Alamos, Bill again approached me about accepting the position with Task Unit 8.1.1. After talking matters over with Rene (who thought living in Honolulu while I was stationed on Christmas Island would be very nice), I accepted Bill's job offer.

The principal business of J Division was to detonate a nuclear device and acquire data of the device's performance by way of special instrumentation. Although by now I had acquired a great deal of experience with radiation detectors, I began attending weapon design meetings and talking to the experienced weapon personnel in J Division. Pretty soon, I felt that I knew enough to take on the responsibilities I had signed up for.

Bill, Lee, and I travelled to Honolulu for a meeting of the JTF-8 staff. Part of the meeting was given over to our proposal for a land-based shot with the diagnostic instrumentation located one mile away. The logistics for such a shot seemed too difficult to overcome and no one seemed to take the idea seriously. Also, as part of this meeting, many of us traveled to the Barking Sands Naval Air Station on the island of Kauai. The purpose of our trip was to assess the Barking Sands facility for launching rockets carrying diagnostic equipment to measure any

exoatmospheric tests we might conduct. A civil engineer showed me a map of the area layout and asked how much space we might need for our equipment. I drew a rectangle on the map for the space required and labeled the center of the area *Point M* for *McGuire*. Although we subsequently used the space I identified, the name *Point M* did not stick.

After the trip to Barking Sands was completed, I prepared to fly back to Los Alamos. Before I could do so, Bill called me from Washington (he did not take part in the Barking Sands trip, but instead had left Hawaii for Washington) and instructed me to report to Pearl Harbor, where I would sail on a naval vessel known as a Landing Ship Dock (LSD) to explore several islands and atolls for possible use as a nuclear test site.<sup>3</sup> LSDs are ships designed to support amphibious combat assault on beaches. They have a deck just above the water line and tanks that can be flooded to lower the ship and this deck into the water so that small boats can float on or off the ship. Hence the word *Dock* is part of the ship's moniker. LSDs, which displace about twelve thousand tons, lay offshore during an invasion and send assault troops and supplies to the beach by their small boats.

At the appointed time, I went to Pearl Harbor and reported to the LSD. A Navy Commander asked for my rank. I said that I had none. He then asked that if I had a civil service rating. I told him no. He then asked that if I had one, what it would be. I replied GS-12, since, from what I knew, it most closely matched my position. The Commander merely made a note and then passed on to the next person. Subsequently, I was assigned a berth in the *troop officers' quarters*. Within an hour, however, I was reassigned to the *troop commander's cabin*. The cabin was really nice, completely private, and outfitted with lockers and even a safe for papers. I also was informed that I would be a member of the Captain's mess. "Will that be for the entire trip", I asked. "Yes", I was told. The captain had his mess in his private quarters and it turned out that there were just two mess mates – the captain and myself. I was not sure I was going to like this arrangement.



**Landing Ship Dock**

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<sup>3</sup> The Pacific Proving Ground, Bikini and Enewetak Atolls, could no longer be used because of international political concerns about the effects of testing on the Marshallese people and their islands.

On the first night out of Pearl Harbor, I was escorted to the captain's quarters by an enlisted sailor, who seemed nervous in the presence of the captain and departed as quickly as he could. The captain welcomed me and offered coffee as we sat at a round table about four feet in diameter. Shortly, the captain rang a bell that signaled chow was to be served. Another enlisted sailor in fresh, clean, well-pressed whites appeared with a tray replete with silver service and our first course. The sailor also took our orders for the following courses and beverages – WOW! My previous sea duty had been in dungarees and often covered with sweat and grease. What was a sailor boy like me doing in the captain's quarters on a capital ship of the Navy?

The captain asked what I thought of his ship. I told him my sea-going career had started in the bilge of a submarine and, while there was clearly no place to go but up, I had never dreamed of going up this far. I also told him that World War II submariners did not feel they were part of the Navy, but that his ship was well organized and smooth running and that I now felt part of the Navy. He seemed to like that. "Thank you for those kind words", he said. Not knowing what to say next, I told him a joke:

The two commanders of the war in the Pacific, Admiral Chester Nimitz and General Douglas MacArthur, decided to have a conference. Immediately, a major protocol issue arose. Would Nimitz go ashore? Would MacArthur go afloat? Both agreed to meet in Manila Bay on a small boat. On the appointed day, Nimitz steamed into the bay with his ship decked out in flags and with a band playing. Once in the bay, the admiral transferred to the captain's gig, a finely appointed launch. MacArthur could find only an old whaleboat powered by six oarsmen. MacArthur's boat stood off proudly with the general standing in the bow. When the two vessels met, MacArthur stepped into the Admiral's gig and the conference began. Almost immediately the two men disagreed violently, exchanging very pointed words. MacArthur suggested that he and the admiral should continue their argument, but alone so that they could not be overheard. Nimitz agreed and sent both crews away on MacArthur's boat. After the two vessels separated, Nimitz and MacArthur continued their argument with much hand waving, causing the gig to overturn. Nimitz immediately told MacArthur that he could not swim. The general, in a Red Cross carry, rescued the admiral and swam to a nearby sand bar. While standing nearly neck deep in water, Nimitz proposed keeping the circumstances of their predicament a secret. He could not swim and did not want that embarrassing fact known. Also, he did not want it known that an Army general had saved his life. MacArthur promptly agreed, telling Nimitz that he did not want it known that he could not walk on water.

I realized I was taking a hell of a chance telling that story, but I came out a winner. The captain laughed and said he really liked the story. I quickly came to like him and thoroughly enjoyed being the only guest at his mess.

As I mentioned earlier, the purpose of this trip was to investigate possible sites for nuclear testing. Our first stop was at Jarvis Island, which lies on the equator south of Kauai at  $106^{\circ}$  west longitude. Jarvis is about two miles long and mile wide and surrounded by a reef.

Because of the reef, our landing party had to fly by helicopter to the island. Nearly the entire island is covered by several feet of bird guano. Despite being uninhabited, we found quite a bit of evidence of past human activity: a few steel rails left by the Pacific Nitrate Company which, for a time, harvested the guano; the remains of a U.S. Coast Guard lighthouse; the graves of three Norwegians; and a recently grounded ten thousand ton Japanese fishing vessel. Neither the Coast Guard nor the Navy knew about the grounded vessel.



**Lighthouse on Jarvis Island**

As part of our investigation, we had to estimate the number and species of every bird we encountered. The Pentagon did not want any bad publicity if our testing should eradicate any species of wildlife. Well, there was one hell of a lot of birds on Jarvis. As we wandered around, the air was filled with birds upwards to a quarter of mile in altitude. Most were Terns, but there were a few Blue Footed Boobies. As I walked in the trade wind, a Booby glided next to me, stationary with respect to me, taking an occasional peck at the bill of my cap. Some of the crew hunted for trophies aboard the Japanese ship, but it did not take us an hour before we informed the captain that we had seen enough.



**Jarvis Island Resident**

Aboard ship, we sat down to draft a report with particular emphasis on the bird population. One of the officers had a bird book and pointed out pictures of the tern and booby. He asked us, and particularly me, to affirm in writing that those were the only two species of birds we saw. I did so gladly, which made me an instant friend. The next issue was how many birds we saw. There ensued a rather remarkable discussion. One person, who described himself as a farmer, estimated the number of birds by how many he saw in one acre and then multiplied that number by the total number of acres. His arithmetic led to an estimate of one million birds. I also estimated one million birds by calculating that half the population was in the air at any one time. I estimated the number of birds per cubic meter for every meter in altitude. All our estimates were for terns. Although there were perhaps only 100 boobies, the species, itself, was not rare. Neither were terns. So off to the Pentagon went our report. The birds could be classified as expendable. I insisted, however, that the report contain my evaluation that Jarvis was not suitable as a nuclear site.

After leaving Jarvis, we steamed west along the equator for about 500 miles until we reached Baker Island. During World War II, Baker was used as an airbase for B-24 Liberator Bombers. In addition to the remnants of the airstrip, which is about 5000 feet long, there were some Quonset Huts and other remnants of its World War II use. Baker had one redeeming feature, there were very few birds. Baker struck me as a good place for a shot. Among other things, it would remove the island from the ocean, although it might create a navigation hazard by leaving a reef covered only by shallow water. We reported to the Pentagon that Baker was preferable to Jarvis.



**Baker Island**

That night, while sailing away from Baker toward our next destination, Howland Island, I received a shock. A message came through that Rene had undergone surgery for cancer. The Captain gave me the news. He also told me that he had already changed course for Canton Island, where an airplane could take me back to Honolulu. I protested, but he told me that was the way it was going to be. The next day we arrived at Canton. The island, which has only about fifty acres of solid land, is jointly administered by the United States and Great Britain. I went ashore and found one runway and no aircraft. Since the island was jointly administered, one side of the runway had US markings and the other side flew the UK flag. I was told that the LSD Captain's request for an aircraft had not been relayed by the Navy to the Air Force. Hence, no plane was coming. I had two choices. I could wait until the next day and take a scheduled flight to New Guinea, where I could take a second flight to Honolulu. Staying on Canton, even for twenty-four hours, seemed unreasonable, so I opted to return to the LSD and complete my mission.



**Canton Island**

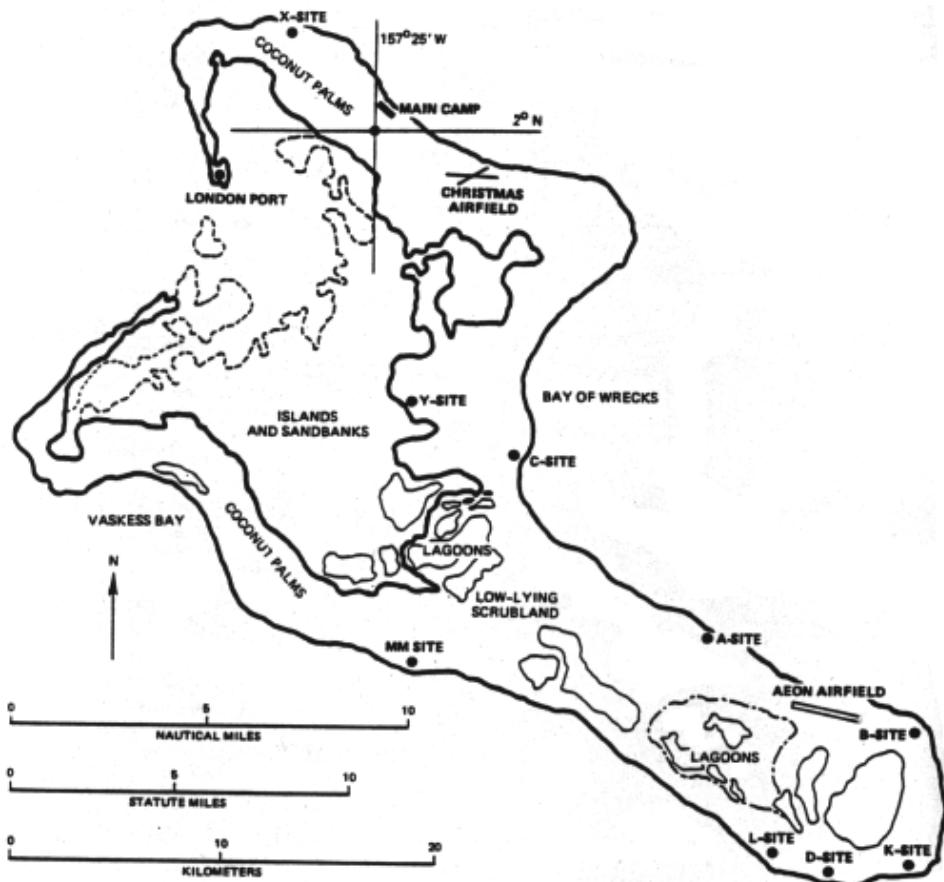
After leaving Canton, we sailed to Howland Island, which lies at about  $178^{\circ}$  east longitude. Howland is about two miles long and one-half mile wide and is entirely covered by grass. Howland has a long abandoned runway, which Amelia Earhart was scheduled to use on her ill-fated attempt to circumnavigate the earth. We found relatively few birds, but in numbers seeming sufficient to keep the feral cats well fed. Howland seemed okay for a shot, but it struck me that it would be too bad to obliterate this particular island and we said so in our report to the Pentagon.



**Howland Island**

After leaving Baker, we returned to Honolulu. I quickly returned to Los Alamos, where my wife was recovering from her surgery. Although I was prepared to give up both the Task Force and the Laboratory in order to care for Rene, her doctor told us that she should be up and about and able to travel to Hawaii by the time the Task Force officially deployed.

At Los Alamos, we received two important messages from Washington. The first message informed us that the British had offered the United States the use of Christmas Island for use as a Pacific test site, with one caveat – no ground shots. The US had quickly agreed. The island, discovered by Captain Cook on Christmas Day, hence its name, lies at three degrees north latitude about 2000 miles from Honolulu. Its use greatly simplified our planning and eventual operations. The second message said that President Kennedy had authorized JTF-8 to officially deploy and commence firing in late April 1962. As a result of these messages, I once again began attending weapon design meetings and getting the LASL detector trailers and their detection instrumentation ready to be shipped to the Pacific.



Christmas Island

At a JTF-8 planning meeting held in Denver, a number of logistical and operational issues were settled:

- The Air Force agreed to provide two C-130 transport aircraft for use as photographic platforms. The Air Force also agreed to provide B-52 bombers to drop our test gadgets and high altitude-capable B-57 aircraft for both radioactive sample collection and photography.
- The Navy agreed to provide the targets for the air drops – barges equipped with lights, radio beacons, and radar reflectors. The major problem was how to anchor the barges in 2000 feet of water. Anchor chains were too heavy and would break under their own weight. The solution was to use a rope of nearly the same density as water. The Naval facility at Barbers Point would be used for receiving the test gadgets from the design laboratories (Los Alamos and Livermore) and for assembling them prior to their detonation.
- Edgerton, Germeshausen, and Grier (EG&G) was contracted to photograph the rate of the fireball expansion. The fireball is the sphere of hot gas – vaporized metal and other atoms – that expands from the point of the explosion at a speed well in excess of sound velocity. As a cloud of dense material pushing a lighter medium – air – it preserves its spherical surface even as the radius increases. As photographed, against what is always a darker background, the resulting image resembles the moon. From the record of the fireball radius versus time, the amount of energy released in the explosion can be determined. As the fireball expands its rate of growth slows until the velocity of the surface drops below the speed of sound. At that point, the shock wave moves off in the air ahead of the fireball.
- Homes and Narver was contracted to construct and maintain the facilities on Christmas Island.
- Exoatmospheric shots would be launched by rocket from Johnston Island.
- The AEC rented a “mini-mall” on Ohohia Street in Honolulu for its forward area activities. The AEC, LASL, EG&G, H&N all had space.

I was concerned that we could not obtain good photographs by simply mounting cameras to the frames of the C-130s. So we conducted a test using a C-130 fitted out with cameras. A B-52 flew out over the Pacific Ocean and dropped a dummy bomb, which contained a few pounds of TNT and a pressure sensitive switch. The dummy bomb exploded, as planned, at 2000 feet. The cameras on the C-130s caught the explosion perfectly. The pilot simply aimed the cameras by flying their planes level on a prescribed heading. They claimed they could do this during an actual test. During Dominic, they did just that.

During this time, as well, we worked out a method to accurately calculate the distance from the cameras to the fireball, a measurement essential in determining device energy yields. An error as small as one percent in calculating this distance creates a five percent error in the

yield measurement. The Air Force equipped each C-130 with a Distance Measuring Device (DME). We, in turn, installed an electronic transmitter in the bomb casing that would send a signal to the DMEs. We achieved accuracy to within a few meters.

Shortly after working out the photography issues, we deployed to Honolulu and our Ohohia office. On this trip, Rene and my five year old daughter, Tracy, were able to come with me – at least as far as Honolulu. We rented a large room on the tenth floor of a good hotel. Rene was well recovered from her surgery and was able to enjoy her time in Hawaii. On our first Sunday, we took a driving tour of Oahu. I was very much relieved that Rene was feeling well and that both she and my daughter could enjoy the island.

While waiting for my final deployment orders, I took occasional trips to our Barbers Point facility. I happened to be there when our first test gadget arrived. It was in a standard ballistic drop case slightly modified with two hinged covers. The fusing and firing electronics were located under the rear cover. The nuclear components under the front cover. The covers were secured by two padlocks – one green and one red. It took three people to arm the device: one person each to unlock the two covers and a third person to install the arming cable. I was greatly amused to see what would happen in case one or both sets of padlock keys were lost. On the wall of the storage building hung two bolt cutters, one painted green and the second red!

A second amusing event occurred one night while I was checking for a gas leak on the first bomb. While waiting for my sensor to take its reading, I noticed that my Marine guard was behaving something less than what is required of a Marine – he was fiddling with his carbine, shifting it from hand to hand, and swinging it around in a haphazard fashion. I walked over to the door and waited for him to walk by. As he did, he inadvertently pointed his carbine at me. I grabbed it out of his hand and held it to my chest. Startled, he lunged at me. I threw his carbine at him in the manner used by drill instructors. He immediately stopped and told me that I was under arrest. I then said that would require a trip to the base commander's office, which was fine by me. I then asked if it were true that his general orders required him walk his post in a military manner. That ended the situation and the sentry returned to his duty.

Before leaving for Christmas Island, two less amusing events occurred. At Barbers Point, I was approached by two Sandia engineers who showed me a piece of paper listing the parameters for the drop case about to be used. They wanted my signature on their piece of paper verifying that the bomb would be dropped from 45,000 feet, that the main electrical battery would be energized by a barometric switch at 30,000 feet, that the telemetry would activate at the correct altitude, and that the detonation would occur at 2,000 feet. I looked wise, said the parameters were correct, and signed their paper.

The second less amusing incident occurred when the Los Alamos Scientific Laboratory (LASL) team leader in charge of in-flight diagnostics for the exoatmospheric tests called and asked to meet with me. He was greatly concerned about the takeoff weight of the KC-135 airplane he and his team were scheduled to fly in. At its current specified takeoff weight, the aircraft would crash into Diamond Head if one engine and/or its water injected thruster failed as the plane rotated off the runway. The solution was simple. Lower the gross takeoff weight of the KC-135 by reducing the amount of fuel. Neither the Air Force nor the LASL project leader,

Herman Hoerlin, would listen to the team leader's concern or solution. I went to the Air Force Colonel in charge of plane loading and asked him to reduce the amount of fuel. Since the proposed reduction in fuel would reduce flying time from approximately eleven hours to eight, the Colonel refused. The colonel also accused me of trying to tell him how to load *his* airplane. I said that if the gross takeoff weight was not reduced, *my* crew would not fly, and he could explain that to his commanding General. As I started to leave, the Colonel changed his mind and agreed to reduce the gross takeoff weight.

When my travel orders for Christmas Island arrived, I boarded a C-118 transport with the rank of a General Officer. The flight to Christmas took four hours. When we landed, the pilot instructed us to remain in our seats. Very shortly thereafter, a very determined British Sergeant-Major marched aboard and strode to the front of the aircraft. He turned and addressed us in a Cockney accents saying, "Welcome to Christmas Island – not a very pleasant place you will find." He then began a long and dreary recitation of safety hazards including sunburn, coral poisoning, traffic accidents and the manta rays in the ocean. "They are (the rays)", he said, "huge beasts that come up out of the water flapping their wings." All of us on the plane were amused and not the least bit intimidated, particularly the ridiculous part about the mantas.



**Christmas Island Airport**



Christmas Island is large, it measuring about thirty miles east to west and twenty-four miles north to south. Although it has about 380 square miles of surface area, about one-third of that area is either a lagoon or low-lying wetland. The Brits had built an airport, barracks, mess halls, office buildings, vehicle maintenance sheds, and even a tennis court. I never saw anyone play tennis, it was just too hot. The highest point on the island is only ten feet above mean sea level. One of our early concerns was whether or not an accidental detonation, if it took place underwater, would create a tsunami and wash away our facilities. Our fears were allayed when an earthquake off the coast of Chili produced a tsunami that had absolutely no effect on the island (there was nothing we could do in any event).

The island also had a copra plantation maintained by a coterie of Gilbert Islanders hired by the Brits on two-year contracts for couples and one-year contracts for single persons. During my entire time on Christmas Island, I saw only ten Gilbertese, part of a musical comedy production put on by the Brits. One of the Gilbertese natives had a hairdo that rose straight from his head to a height of about eighteen inches – much like a cylindrical chocolate cotton candy carnival treat. An AEC employee sitting next to me asked if the fellow with hairdo was a scientist.

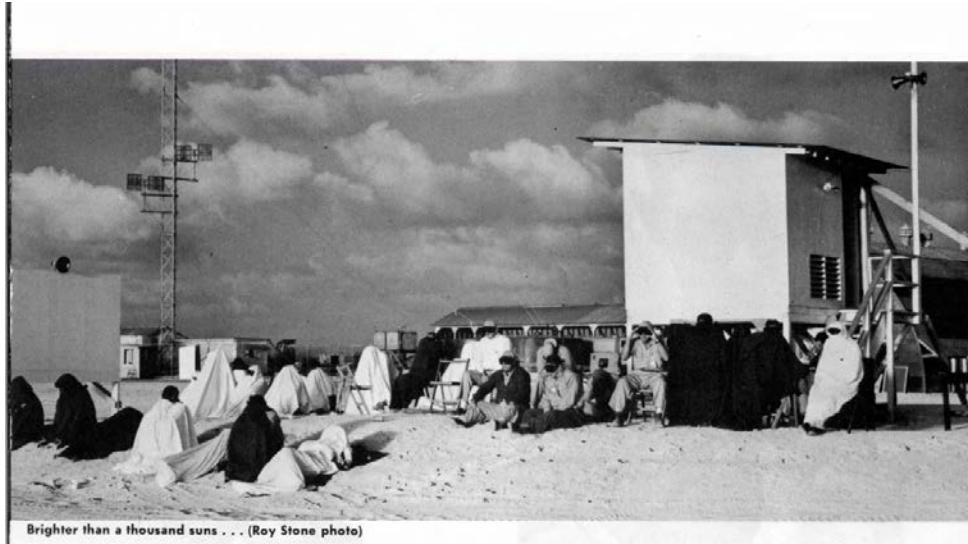
Lee Aamodt and I, along with our diagnostic trailers, moved into Site A, which consisted of a tent city, mess hall, gas station, shower facility, and an office building. Our trailers were oriented with the rear door facing west. The target barges were located in the open ocean southwest of Site A. The shower facility was not yet fully constructed and the mess hall and its food were miserable. Very quickly, the JTF-8 brought in a support service contractor along with a Honolulu restaurateur of reputation. The food quality and service quickly became excellent.



**Site A**

One of the quirks of Christmas Island was the two lane road between Site A and the main camp, located near Port London. The road had two lanes, only one of which was paved. When two vehicles met, whichever one had the paved lane to the left could stay on it. I made at least one hundred trips on this road between Site A and the main camp.

Our first test was scheduled for the latter part of April. As the date approached, the JTF staff conducted a general briefing with special emphasis on the use of dark goggles because, if one looked at a nuclear detonation from a distance up to about fifty miles, temporary flash blindness could occur. Permanent blindness could result from looking at an explosion at a distance of only twenty-five miles – even from relatively small tests. In addition, a one-megaton explosion, can seriously burn exposed skin from a distance of only seven miles. This JTF briefing also covered the effects of shock waves. A shock wave, of course, is an instantaneous rise in the atmospheric pressure which travels through the air at the speed of sound. The pressure of the shock in excess of atmospheric is called over pressure. At a distance of seven miles from a megaton explosion, the shock over pressure is approximately one-half pound per square inch (psi). Over pressure above this level will cause structural damage to buildings and a two psi over pressure will demolish many buildings. The last topic covered was radioactive fallout. The point made was, of course, not to be downwind from a nuclear explosion.



### Shot Day Precautions

On April 25<sup>th</sup> at 3:00 am local time, we were told that a B-52 with our first test device aboard had departed Barbers Point. This was unwelcome news since we were standing in the middle of a violent rain squall with virtually no visibility. In other words, we would not be able to see or photograph the explosion. After some discussion, Lee issued the abort signal "negative, negative, negative." The bomber, as prescribed by operational procedure, was to make a wide circle and make another drop attempt in fifteen minutes. At this point, Lee had limited options. He could order the drop of the device on the next pass, or send the bomber and a live nuclear device back to Hawaii. If the bomber were sent back to Hawaii, the test device would have to be jettisoned, rather than risk an accidental detonation on landing near a densely populated city. After consulting with Bill Ogle and myself, Lee ordered the test device dropped, knowing that there would be no photography of the fireball. Lee was counting on the B-57 sampler aircraft collecting sufficient debris to make the calculations. I had no particular worries about the device, itself, having already thoroughly reviewed its firing circuitry.

As soon as the device was dropped, our public address system announcer, whose codename was *Mahatma*, began counting down the time to detonation, beginning with "minus one minute." A telemetry signal from the falling device allowed Mahatma to keep track of the rate of descent. Mahatma next called out, "minus thirty seconds," quickly followed by "minus fifteen seconds, minus ten seconds, minus five, four, three, two, one." I don't think he ever said "zero." We did not see or hear anything except the pouring rain on our Command Post (CP). About five seconds later, we felt a modest shock wave pass over our CP.<sup>4</sup> Immediately after the shock wave passed by, Lee looked at me and said, "I am going back to New Mexico. Good bye and good luck! I will be on the island for a few days if you want to ask me anything." With that he left CP.

<sup>4</sup> The device, codenamed *Adobe*, gave a yield of 190 kt.

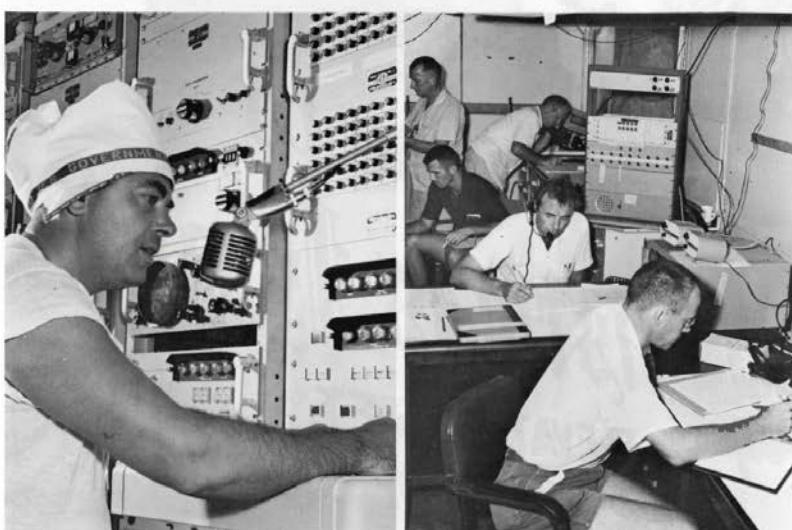


A typical technical conference at Christmas Island.

(Roy Stone photos)

Voice of Mahatma Tom Armstrong, heard all over the island.

B. C. Lyon, Ted Crawford, Austin McGuire, Art Scheiberg at CP.

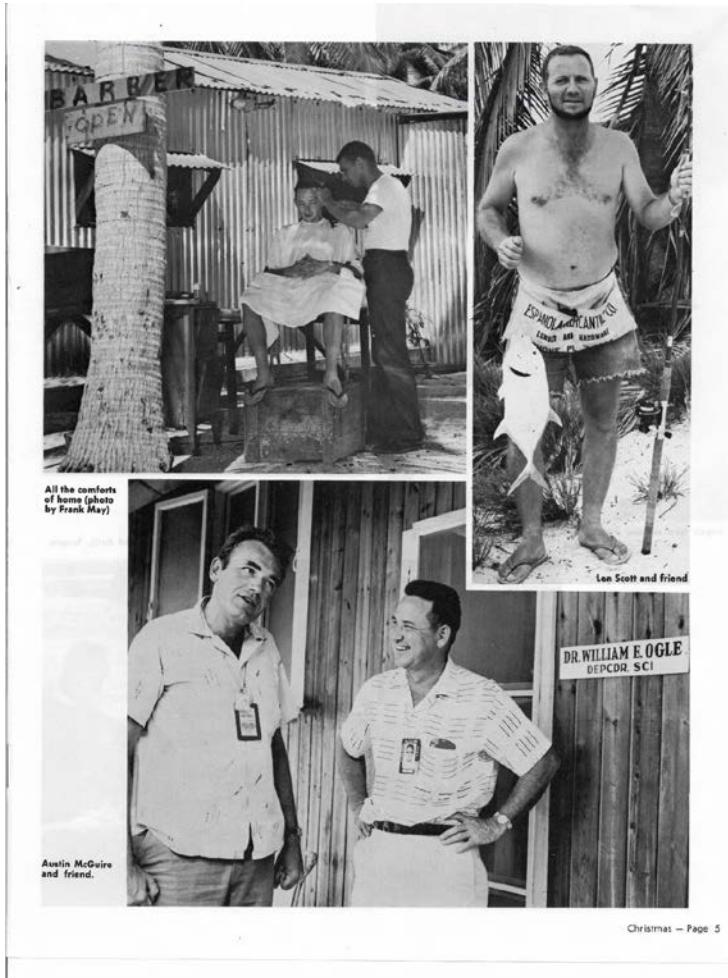


Christmas — Page 2

**Top photo: I am at the far left. Bottom Left: Mahatma. Lower Right: I am in the sitting at my desk with headphones.**

Shortly thereafter, came a knock on the CP door and in walked a rather upset but polite member of our Task Unit dressed in sandals and a poncho with rain water running off in a stream. He said, "Hey did you guys not see the rain and realize that our cameras could not record the fireball?" Almost immediately, a second fellow, also dressed in sandals and a dripping poncho, came in and said, "Hey, I want to show you a photograph of Adobe as seen from Site A." He handed me a Polaroid photo of a gray rectangle. He also said, "My meters indicate that there was no explosion." I could only say that "Lee was in charge until a few moments ago, I am in charge now. Something like this will never happen again." "Yeah, sure," they said, and splashed off in the rainstorm and three-inch deep mud.

When the rain stopped, I got in my jeep and drove to the main camp to talk to Bill. Bill told me not to feel bad about the lack of photography since the B-57 aircraft had collected good samples. I told Bill that "I swear I am not going to drop one in a squall." He looked at me and smiled and said, "I bet you don't." As I later learned, the weapon designers were not too upset by the lack of photographic data. Adobe was a verification test of a gadget that had already been proof tested. The designers learned all they needed from the debris analysis.



**Bottom: Bill Ogle and me.**

The next day, at the main camp, the commanding general of JTF-8, Edwin "Dodd" Starbird, called a weather briefing. The meeting included everyone down to the task unit level. I got to the meeting a bit early and took a chair at the trapezoidal table. Bill immediately told me to get up. I had taken the chair of an Air Force Brigadier General. After speaking to Starbird, Bill told me to take a seat six places removed from the commanding general. The meeting discussion focused on how bad the weather had been for Adobe and speculated on what the weather would be like over the next few days. A Navy commander gave a long-winded talk that boiled down to his saying he could not make a prediction. The Air Force general said that he had ordered additional weather reconnaissance flights that would, he promised, provide better predictions.

General Starbird announced that the next test gadget was sitting at Barbers Point and was ready for delivery. He then asked when we wanted it delivered. Everyone looked at me. I said, "Tomorrow." To which the general replied, "Okay, but you know Mac, even I can't predict the weather." I said, "Okay, but sir, weather is not really a problem for a patient person. All one has to do is wait and pretty soon it is okay." Starbird looked at me skeptically, but said, "What time tomorrow, Mac?" I said, "Oh five hundred." He said, "So ordered."

I returned to my CP at Site A and called a meeting of the task unit, about ten persons. I also invited our chef, since he would have to serve breakfast based on our timetable. I told everyone that the next test would be tomorrow morning at five am. Breakfast would be served at 4:30 am. Everyone, including the chef, would be ready.

Paul Guthals, who commanded the B-57s and their radioactive debris collection missions, also was present at the meeting. It was Paul's job to make sure the planes were at their proper altitudes and for the removal of the filter papers from the planes once they landed. Paul requested a communications link between his command and mine in order to give live status reports from the air prior to shot time. We established the link.

Mahatma woke us up at 4:00 am the next morning saying, "There will be a test at oh five hundred today. Beginning at oh four forty-five, dark goggles must be worn." I rolled out of my cot and headed to the mess hall. The scrambled eggs were fresh and the sausage good. So was the coffee – three firsts for the Site A mess hall. After eating, I headed to the CP and to its communications links to each of our groups and to Paul, now flying in one of the B-57s. Everyone was ready. When Mahatma announced, "minus one minute," I looked out my door and looked toward the target. There was a bank of low-lying clouds, just off shore, that interrupted my vision of the target area. Remembering my promise not to fire unless we could photograph the fireball, I went back into the CP and gave the abort signal, "negative, negative, negative." Fourteen minutes later, as prescribed, Mahatma gave the "minus one minute," warning. I looked out of the CP and saw that the target area would be free of clouds. Since I did not completely trust the shock over pressure prediction, I yelled, "Everybody grab your glasses and get your rear ends outdoors in fifty seconds. We will let this one drop." Mahatma said, "minus thirty seconds." Our instruments were all functioning properly. Mahatma said, "minus fifteen seconds" and then "drop case released." I said, "Okay, glasses on, asses out." We left the CP and stood well away from anything that might liberate debris as the shock wave passed.

There was a brilliant light in the southwestern sky about five degrees above the horizon. I saw the fireball some seven statute miles distant at a height about 2500 feet over the ocean. I also felt the stinging blast of infrared radiation from the fireball. In about thirty seconds the shock wave arrived.<sup>5</sup> The shock wave was predicted to be of one-half psi, but, in fact, it was at least twice that prediction. After some laughing, joking around, and congratulating ourselves, we went back to the CP. Well, our trailer was a mess. The shock wave had driven the doors into the CP and pinned them to the walls. The florescent lighting fixtures were dangling near the floor, swaying in the trade wind. The interior structural ribs of the trailer were clearly visible on the exterior surface, having been driven outward as the shock wave passed through the CP. Our

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<sup>5</sup> Aztec, gave a yield of 410 kilotons.

diagnostic equipment worked (the power grid was undamaged), and we acquired good set of data. Paul Guthals reported that the airborne sampling operation had collected a good sample of debris. I reported to the main camp that all had gone well and then went to the mess hall for more of the good coffee I enjoyed a short while earlier.



**Aztec**



**B-57 Sampler Aircraft**

Since there would be about a week before our next shot, I temporarily relocated to the main camp. As a Task Unit Commander, the equivalent of a Brigadier General, I had two seats available at the Commanding General's mess. The mess had dining tables with white cloths, good quality china, glassware, polished utensils, and napkins! Also, orders were taken and the meals served by Philippine orderlies dressed in sparkling white uniforms. I faced a dilemma - who to invite to use my second seat. Since it was impossible to decide who to give my second seat to, I ate at the regular mess rather than hurt anyone's feelings. By chance, Harry Allen, the LASL supply and property manager, was making an inspection tour of Christmas Island. Harry tracked me down and said, "Mac, about the general's mess, I would really like to use one of your seats." I said, "Go ahead, Harry, but I won't be there myself." Harry did so for about a week, before going back to Los Alamos.

While at the main camp, I wrote and sang a couple of songs for my task unit.<sup>6</sup> I thought it would be a good way to entertain my unit. My first song, composed to the tune of an English military song, "*Troop Ship*," went like this:

I came down on a C-118  
And the funniest thing that I've seen  
Was a sergeant who marched up in British type shorts  
And said, "Caution is required while engaging in sports"

"Now one painful lesson you'll learn  
Is that coral enhances sunburn  
The direct radiation will cause you great pain  
And the reflection will get you again  
And remember now well what I say  
About going out there in the bay  
It is full of sea life, which can cause you great strife  
It is best if you just stay away"

"For if ever you're out in a boat  
It is doubtful that you'll stay afloat  
When that huge manta ray leaps up out of the bay  
And you find out how hard you've been smote."

To my amazement, it was a smashing success. Everyone could relate to the father figure of the British Sargent Major giving his mandatory initiation for everyone arriving at Christmas Island. Everyone shut up, listened, howled with laughter, and applauded.

It was my great fortune that Harry Allen was still on the island when I sang my song because one of the screw mechanisms that puts tension on the guitar strings, broke. The mechanism consisted of a plate which was screwed to the wood of the guitar neck and on which were mounted three spools that took up the guitar strings when tension was increased. Without

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<sup>6</sup> I had my guitar and used it to accompany my singing.

my guitar, I would be lost.<sup>7</sup> So, I took the broken mechanism to Harry and asked if he could find a replacement. In about twenty-four hours, Harry put a new one in my hands. That, to me, was one of the most amazing things that could happen. With my repaired guitar, I wrote another song, this one to the tune of “*Don’t Sit Under the Apple Tree with Anyone Else but Me*.”

“When you hear Mahatma shouting early in the morn  
Piping on the horn, dark glass must be worn  
When you see that mushroom cloud come rising from the sea  
Take this advice from me

Now don’t stand under a coconut tree when the shockwave gets up here  
Stand out in the clear with your finger in your ear  
It is appalling should a falling elongated sphere land behind your ear  
Now I just got word from a guy who heard from the base dispensary  
They picked up a case with a dark blue face laying underneath a coco palm tree

Soooooo...

Don’t stand under a coconut tree when the shockwave gets up here  
Stand out in the clear with your finger in your ear  
That’s the best advice we’ve had in all the long career of a safety engineer

At the May 1<sup>st</sup> weather briefing, I was told that the next test device, codenamed, Questa, was ready and would May 4<sup>th</sup> be okay for the drop? It was. On the morning of May 4<sup>th</sup>, the B-52 arrived on schedule, the weather was acceptable, all instrumentation ready, so I gave the drop signal. Immediately afterward, I checked on the data acquisition at both A and MM Sites. I then reported to the JTF that CTU 8.1.1 was happy.<sup>8</sup>

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<sup>7</sup> Mac became known as the Poet Laureate of the mid Pacific. The lyrics to all of his songs appear as Appendix A.

<sup>8</sup> The yield was 670 kt.



**Checking the weather prior to giving the “go” signal.**

While waiting for the next event, codenamed Mesilla, I received an invitation from the British Commander to join him for drinks at one of his Pavilions. A Pavilion was a structure with a poured concrete floor and a roof. They also had an enclosed space for service personnel to mix drinks. The invitation, itself, was a masterpiece of the printers’ art. It was four-inches square with stiff paper board in the center surrounded by thinner paper that formed a three-quarter-inch margin. The raised silver thread lettering was old English saying, in effect, that my presence would be greatly appreciated. I ran into General Starbird, told him about the invitation, and that I wouldn’t be going because I did not have the proper attire. My entire wardrobe consisted of shorts and short-sleeved shirts. Dodd said, “Mac, you are just about my size. Come by my quarters and I will lend you a long uniform.” I was amazed, but took him up on his offer, and went to the party. I was one of the few Americans at the party, not even Starbird was there. The waiters were Black, wore sparkling clean uniforms, and carried silver trays all the while taking drink orders. I had a gin and tonic. I do not recall finding anyone interesting to talk to, but the site of those Brits drinking gin from crystal glasses on the equator was a scene to remember. I gave Dodd back his uniform without sending it to the laundry. Immediately after returning it, I realized I should have had it cleaned.

*The Officer commanding and Officers  
Royal Air Force Christmas Island  
request the pleasure of the company of  
Mr. A. McGuire  
for drinks 6.30 - 8.30 pm.  
Port mess, 6th July, '62*

### **My Invitation**

Since Dodd and I were about the same height, six feet five inches, the officers on his staff suggested quite often that we stand back-to-back and find out if we were the same height or not. Dodd repeatedly refused. Once, however, I stood and turned back-to-back with him but, before we could get close enough to measure, Dodd broke his knees, ending my experiment. At the close of Dominic, we still didn't know whether or not one of us was taller than the other.

For me, a civilian and scientist, Christmas Island was a collection of different peoples and cultures, specifically the Gilbertese, the Army, and the Navy. The Gilbertese people were interesting because they had little conception of nuclear testing and its possible effects on them as human beings. We, of course, knew how and when to take precautions, such as preventing eye burns. Not so the Gilbertese. Since we would not guarantee that they would follow all precautions, we enticed them with promises of movies and food to board our LSD immediately prior to each test. The LSD would then sail over the horizon. This plan worked well the first time, but not the second. The problem was the movie selection – it did not meet the approval of the Gilbertese. Subsequently, we let the Gilbertese choose what they wanted to watch.

Christmas Island has two distinct forms of life – land crabs and frigate birds. The land crabs came out at night and covered a good fraction of the land and road around the main camp. When driving on the paved road, there was the “crack” of a crab being crushed at a rate of about three per second. Frigate birds are black and about as large as a medium sized chicken. They live by fishing, often by moonlight. Near our communication towers, we often found partially digested fish. Frigate birds were obviously flying into the tower guywires causing them to regurgitate their partially digested meals. Frigate birds often looked the wrong way during tests and were blinded by the flash of the detonation. After each shot, there were usually a dozen or so blind birds wandering over the beach. The Army sent out a squad of men armed with shotguns to dispatch these birds. That always was a vivid reminder of what we were doing.



**A common site.**

The Army could be, from time to time, very nettlesome. In early May, I found a memo signed by General Starbird stating, "In the event it becomes necessary in an emergency to land a B-52 on this island with an armed weapon aboard, (I thought it was about time someone at the command level thought about this issue) your task unit is here by assigned the responsibility for disarming the device." Well, okay, I thought, although the responsibility was really that of the Sandia Task Unit. And then, I thought of the red and green bolt cutters at Barbers Point, would I need one of each? And then the memo got both interesting and infuriating. Starbird instructed me to identify the person in my task unit that had the capability of disarming a gadget, give that name to the General's chief of staff, and order that person to report to the chief of staff two hours prior to each scheduled shot time. That was too much. I did not think badly of Dodd. Although he had signed the memo, he obviously had not read it. I was angry at his chief of staff who obviously was out to cause me trouble.

I responded in writing to Dodd saying that per his order (that you will name a person to report to the chief of staff), "I will not." My memo went on to say that I would gladly accept the responsibility for disarming the gadget and that the full capability of my task unit was available to him anytime via existing communications. All he had to do was call. I ended my memo by saying, "If the situation arises I will be there and you can rest easily on this subject."

Then next morning I received a phone call from a frosty General Dodd. He said, "Dr. McGuire, don't you understand that you are to take orders just like any other officer in this task force?" I responded, saying, "Well, there is a minor point of difference. I am not subject to the uniform code of military justice." A pause ensued as Dodd was deciding what to do about me. Before he could say anything, I asked him to read the second paragraph of his memo. After a bit, he said, "Mac, someone on my staff wrote that memo to you." "I know," I said, "and I was really writing back to them. Now look," I continued, "I am pleased to take responsibility for disarming

if you want me to. I assure you, it no big deal. I will be there.” Dodd said, “Sure you will. I won’t worry about it.” As the operation wore on, and I saw more and more of Dodd, I came to admire and respect him greatly. I wondered how the Army could produce and promote such a fine officer.

Also stationed on Christmas Island, was a Rear Admiral that I did not care much for. He seemed to be intoxicated with his own importance and authority. One day, early in the Operation, a Lieutenant Junior Grade (LJG) came into my office at Site A with a very serious expression on his face. His hand twitched in a way that told me he wanted to salute, but realized that a naval officer does not salute a civilian (except the President of the United States). He said, “Compliments of the Admiral, who wishes you to accompany him on a fishing trip leaving port tomorrow at 05:00 hundred.” My jaw dropped. I said, “Did that idiot send you fifty miles in a jeep to tell me that? Sit down and have a cup of coffee.” The LJG relaxed, felt better, and took the coffee. After a while, I said, “I do not care how you put this to that idiot, but I am busy and have no time for fishing. Come again when you can stay longer. Nice meeting you.” He left.

Some weeks later, I received a second invitation. Not being as busy, I decided to accept with the idea that if I got better acquainted with the admiral, I might like him better. When I arrived at the port, I found the admiral’s fishing boat, a converted PT with the two bright stars, signifying a Rear Admiral, painted on the port and starboard sides of the bow. Two deep-sea fishing chairs were mounted in the stern. The boat had a crew of four and plenty of beer, sandwiches, bait, and tackle. As the admiral came aboard, the skipper, a Chief Petty Officer, saluted in trim (true) military style. As the lines came in, we headed out, I was invited to sit in one of the two fishing chairs – the admiral sat in the other. The admiral wanted to catch a marlin, something he had not yet done. We trolled for about four hours, catching just a few fish, the largest being about twenty pounds. I could not identify the species. We saw manta rays and frigate birds, one which dove on my bait and got my hook caught in his mouth. I reeled him in and the crew was able to extract the hook and release the bird.

While trolling, I tried to warm up to the admiral by telling him some ideas I had about detecting Soviet submarines. He told me that it was not all that hard to find Soviet submarines – all one had to do was to lay off Vladivostok and wait for them to leave port. After some thought, I decided he was completely right.

When we got back to port, the admiral looked in the ice locker where our catch was stored and said, “The biggest one in mine, put my name on it.” Actually, I had caught it. That evening, I was invited to dine in his mess. The Navy cook made a grand entrance with my fish on a platter. The admiral’s story about how he had landed it was received in awe by his junior officers and in quiet amazement by me! My get acquainted effort was not successful.

Such was life on Christmas Island for me. By the end of May, we, Los Alamos, had conducted six tests, all dropped by B-52s. Livermore, “the other place,” had also conducted six tests. In addition, two operational weapons were fired high above Johnston Island. One weapon, carried aloft by a Polaris rocket, was detonated at an altitude of 110,000 feet. For this test, I traveled to our MM Site to record the arrival of the electromagnetic wave generated by the

explosion and to determine the time of detonation to an accuracy of one microsecond. The second test, Swordfish, was a Los Alamos designed warhead for an anti-submarine rocket.

One of our tests caused a great deal of excitement for both my staff and for the Air Force. Since the yield for this event was predicted not to be very large, zero time was in full daylight, and much closer to Site A than previous shots. The burst altitude was 2,000 feet. When the initial radiation exposure was over, I heard a great shout from Site A personnel. To a man, they believed that they had seen a missile from a Soviet submarine enter the fireball about three seconds after the burst. Yeah, sure, I thought. Then it occurred to me that the bomber had released two objects: the test device as well as a bomb case containing radiation detection instrumentation. The plan was to release the second bomb case at a predetermined distance of a few hundred yards from the explosion. I believe that what they saw was the second bomb case, smoking hot, falling away from the fireball. I asked, "Did you see the rocket exit the fireball?" I did not get a precise answer.

I immediately went up to the film trailer at main camp and looked at the processed film from the land-based cameras. I found clear images showing the hot, smoking second bomb case falling away from the fireball. I then went to the Air Force general and asked him if he thought a Soviet submarine had penetrated the exclusion zone surrounding the test area. He had already ordered a search and destroy mission consisting of P2V aircraft carry depth charges. When I told him that the supposed rocket trail was going down and not up, he did not believe me. "Are you sure, Mac?" I was ready for this question and asked him to look at the photographic record showing the vector of the falling instrument case. I told the general that I would not tell anyone else, unless ordered to do so by General Starbird. I did not hear anymore about this matter, but I did make a new friend.

During this time, I also made repeated visits to Honolulu and, like everyone else, had to endure a lengthy customs inspection on each trip. When we arrived at Hickman, a military air field, we had to take a bus over to the civilian field to go through both immigration and customs. Immigration was no problem since we arrived by military transport. At customs, we often had to wait for more than an hour just to show the inspector, literally, our dirty laundry. When we complained to the chief customs officer, he offered no hope and suggested we petition to give him a larger staff. He came across as a civil servant who could not be reasoned with. To counter this indifference, one of our guys hit on an ingenious plan. When we again travelled to Honolulu, he brought along a gunny sack full of liquor bottles. He immediately declared his "import" and asked to pay the tariff. None of the liquor bottles were full and, in addition, some contained whiskey and some wine. As a bunch of us watched, the customs agent duly began recording the amount of liquid in each bottle and the amount of duty. Immediately, our guy said, "I will not pay, that is too much." "Why?" asked the customs agent. The reason was simple enough, some bottles contained wine, which was taxed at a lower rate than whiskey. After recalculating, the customs agent came up with a new amount. Once again, our guy would not pay, saying that some bottles were imperial pints and some imperial quarts. The customs agent tried to figure out how to convert imperial volumes into their U. S. equivalents. Of course, we offered no help in the matter. At this point, the chief customs agent came out and told us to stop harassing his staff or bad things would happen. We, in turn, told him that if we did not clear customs on our next trip in fifteen minutes, he was in for a real hassle. When he asked what that might be, we told him

that we would tell his superiors that he and his office could not compute the import duty on our sacks of alcohol. We finally paid a duty on the sack of bottles and left. Our next trip through customs went much quicker.

One day, in the mess hall back on Christmas Island, I happened to sit next to an Air Force pilot. When I said I was from LASL, he reacted, "LASL, hey!" He told me he had just flown in from Johnston Island, where a number of my colleagues from LASL, were trying with a great deal of difficulty, to conduct high altitude tests. Johnston Island is very small, about two miles long and one-half mile wide and, because of the tests, was overcrowded. In fact, this pilot had had a difficult time finding a place to park his plane overnight. When he came out the next morning to take off, his path to the runway was blocked by a newly installed tower guywire. He found the owner of the cable, Herman Hoerlin, who refused to move the cable so that the plane could take off. Herman did offer to put a red flag on the wire. It took the efforts of the island's commanding general to remove the cable and let the plane leave. Well, that was Herman, I thought.

While operations were taking place on Johnston Island, I took the opportunity to spend time with my family in Hawaii, as well as taking time to look over the data we had been collecting on Christmas Island. I also took the time to compose a new song dedicated to the problems Herman and others were having on Johnston Island.

*Southwest of Honolulu there's an island low and small  
If it were any lower it would not be there at all  
It has a camp and runway and a missile launching pad  
And if more space is needed it will be just too GD bad.*

*Now we had a little fire out there on the launching pad  
A careful search revealed that that's the only pad we had  
We messaged to the President there's been a small delay  
He messaged back, "My goodness, you were supposed to shoot in May."*

*Now we launched a missile nicely and it went up in the air  
But suddenly the radar couldn't find it anywhere*

*SO:*

*Destruct it, destruct it, we don't know where that little mother went  
Destruct it, destruct it, can't take a chance the orbit might be bent.*

In retrospect, it was perhaps not too appropriate. I never did sing it for anyone.

Back to Christmas Island and our next shot, Alma. It was a big one, nearly a megaton in yield.<sup>9</sup> I gave the negative call sign on the first pass and then let the bomb drop on the second. We had a good view of the fireball from about eight or nine miles and rousing shock wave.

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<sup>9</sup> Alma has a yield of 782 Kilotons.

On one of our subsequent tests, Paul Guthals radioed that the B-57 sampling plane he was riding in had aborted its flight and was returning to base, where Paul could change planes. I gave the negative signal on the first pass. Paul was back on station quickly and I let the bomb drop on the second pass. Paul later reported that his original plane was giving bad indications on its instruments. While the pilot thought the plane was okay, he had followed safety regulations and returned to base.

While we were testing on Christmas Island, an additional set of tests, codenamed Operation Fishbowl, were being conducted on Johnston Island. On July 9<sup>th</sup>, a test called Starfish Prime was detonated 400 kilometers over Johnston Island. The yield was 1.4 megatons. At the time of the detonation, I was standing on Christmas Island, virtually on the equator, twelve hundred miles to the southeast. I saw a flash of light, presumably a reflection of some sort. Then, I saw a narrow band of blue light following the line of the earth's magnetic field that eventually dipped down below the equator toward New Zealand. The blue light was generated by electrons emitted during the detonation. The path of the electrons was influenced by the force of the earth's magnetic field, such that the particles circled around the magnetic field and simultaneously moved along it in a helical path. In the process of circling, the electron accelerated and thus radiated blue light. I saw the electrons reflect back and forth between New Zealand and Johnston Island in several distinct bundles until there was so much mixing that there appeared to be a blue sausage of radiation spanning the sky and looping over the western horizon. I stood in awe. We all knew that the electrons were expected to circle around the earth's magnetic fields and then reflect when approaching the stronger magnetic field near the poles. And, since the earth's magnetic field is not a perfect dipole shape, the electrons would eventually migrate eastward. Well, they did, presently passing directly over my head.

But, there is more to tell about the blue light. In the blue sausage, which was well above the earth's atmosphere, there was some sort of gross interaction among all the constituent particles that created several streams of blue light-radiating plasmas, not just one stream. These separate sausages developed kinks, wiggling in such a way to suggest that there were both attractive and repulsive forces at work. These new sausages migrated east over my head and out over the horizon. These were surely one of the most amazing things I have ever seen, or will ever see. To this day, I don't understand why I did have all of our photographic equipment pointed at those sausages.

Another interesting thing about Starfish was that the gamma rays produced by the detonation knocked electrons off their atoms of a dipole layer with both electrically positive and negative poles. Since this layer is time varying, it radiates an electromagnetic wave, or pulse, known as an electromagnetic pulse (EMP). The Starfish EMP, as measured at Honolulu, was about 20,000 volts per meter. It was enough to induce pulses of electrical current in the power distribution lines. The result was like a short circuit or downed power line. Oahu went dark for a short period of time.

About this time, I discovered that I could draw a crowd when I playing my guitar and singing some of my songs. My most popular song was written to the tune of a song called "*My Son Calls Another Man Daddy*."

Down on a little coral island, deep in the blue Pacific Sea  
I came to watch the Air Force dropping H-Bombs  
Form forty-five thousand feet down close to me.

With my telescope and camera  
I photograph the bursts within my field  
They scrutinize the image in my record  
And write a memo telling of the yield.

Now when I run into the general,  
The admiral and the air vice marshal too  
I pass to them my standard little message  
Saying, please sir “is there nothing you can do”

Chorus:  
To get me off this island  
Please sir, hear from me this plaintive plea  
Oh!! Get me off this island  
This pile of coral is not the place for me

I tell my fellows in the mess hall  
I tell just anyone who's close to me  
Sent twixes to the Army and the Navy  
To the Air Force and the Chairman AEC

Chorus:  
Saying, Ohhhhh!! Get me off this island  
Won't someone hear my plaintiff's cry  
Oh get me off this island  
I want to go home before I die.

At night along the lonesome beaches  
Staring out across the breakers' foam  
I shout my little message to the trade wind  
Won't someone fix it so I can go home?

Chorus:  
Ohhhhhh!!!  
Get me off this island  
Please won't someone hear my desperate call  
Ohhhhhh!!! Get me off this island  
I just want to go back home – that's all.

On July 10<sup>th</sup>, we detonated a one megaton device codenamed Sunset. At that time, Sunset was to be our last test. The shot went off without incident and I immediately prepared to fly to Honolulu and write my Task Unit Commander's Report at our Ohohia Street office.



**Sunset**

Before doing so, I took some time off to vacation with my family on Kauai. While walking down a path from our hotel lobby to the swimming pool with my daughter, Tracy, on my shoulders, we passed a group of men in street clothes: that is, long pants and shirt sleeves. One of the men seemed familiar, and I turned to take a second look. It was John Wayne. Without makeup, he was barely recognizable to me. It turned out that he was there filming the move *Donavan's Reef*. Later, when Rene, Tracy, and I were waiting for the dining room to open, we saw Caesar Romero sitting across the room. Tracy ran over to him and stood at his knee. He smiled at her and picked her up and put her on his lap. We talked to him for a bit and invited him to join us for dinner. Unfortunately for us, he was waiting for some friends to arrive – which they shortly did.

After our vacation, it was back to Honolulu and my Task Unit Commander's report. Word came quickly, however, from Bill Ogle that we were not done testing. Apparently, since the Soviets had not stopped, President Kennedy gave us permission to continue for a short time. "Back to Christmas Island," I asked Bill. "No." he replied. All our operations would be airborne, including my diagnostic responsibilities. That was good news for me. I could stay in Honolulu with my family.



**William Ogle, only one of two Los Alamos staff members to appear on the cover of Time. The other was J. Robert Oppenheimer.**

A number of RC-121 aircraft, the military version of the four-engine Constellation airliner, were outfitted for our use. The aircraft I was to fly in had a number of radar sets installed along with a communications panel complete with a switchboard and a desk. An Air Force Brigadier General and I were to sit side-by-side at the desk. I would control the communication channels to my team, while the general would control communications to the military flight personnel. Following our basic operational procedure used at Christmas Island, part of my team would fly in the C-130 and B-57 aircraft that would fly in formation with the B-52 drop plane.



**Constellation Aircraft**

We flew a number of practice missions from Honolulu to our planned drop point near Johnston Island. Each mission was difficult, taking about eleven hours on average. Many of the flights had problems. On one occasion, we had a flat tire as we rolled out for takeoff. Fortunately, we were still at a relatively slow speed. Nonetheless, the plane yawed and the wingtip on my side of the plane touched the grass growing on the side of the runway. On three occasions, my plane landed on three engines. Given the number of engine errors and the number of planned takeoffs, I thought it might be just a matter of time before we would be trying to takeoff on only two engines.

On takeoff, I sat next to the Air Force General. On one flight he handed me a newspaper article and said gruffly, "Read this Mac." It was a story about two Constellations that had successfully ditched on two engines. I handed the article back to the General and looked at him inquisitively. He said, "Well, now we know, Mac, these planes won't fly on two engines, but they ditch nicely." I felt much better.

Because of my responsibilities, I was always up four hours prior to takeoff to inspect our equipment, the drop cases, and the photographic gear on the C-130s. After takeoff, I would go to sleep in a bunk on the Constellation with instructions to wake me when we reached our station. Some of the flight crew thought that my sleeping while in-flight was not acceptable behavior. On one flight, an officer commented, "Well, that's Mac, he's civilian. He thinks that his rank insignia should be a couple of silver dollars on his shoulders." I asked the Captain if he had ever been on a submarine. He said no and added that he thought submarines were to be feared. I told him that I had spent some time on submarines during World War II and had further earned my silver dollar rank by getting a Ph.D. in nuclear physics. "Do not salute me though," I said.

Finally, it came time for our first event, codenamed Chama. I was up, as usual, four hours before takeoff. About two hours after takeoff, the general awakened me with a brisk shaking and said, "Get your ass on station." I did and found out that there was trouble in one of the C-130s. The plane's cameras had fired prematurely using up all of the available film. Well, that was not too serious since the camera in the second C-130 could do the job. About a half hour later, a power failure occurred in the second C-130 making its camera mission very questionable. I tapped the General on the shoulder and said, "Let's go home." The General turned our formation around, and we returned to Barbers Point.

During the delay caused by our aborted mission, I received a call from the general telling me that he was going to discipline one of the B-57 pilots. He was giving me a courtesy call because I (and by extension Los Alamos) was the user of the samples collected by the B-57 aircraft. I asked that I be given a couple of days to investigate and give him my opinion about whatever was going on. He agreed. After hanging up the phone, I called Paul Guthals and asked what was going on. The pilot, whom Paul thought was the best in our fleet, had angered the general during an earlier shot. Paul asked if I remembered the event on which his plane had experienced trouble requiring us to delay the shot until he could return to Christmas Island and swap out his plane. "I do," I replied. "Well," said Paul, "the pilot was ordered to land the troubled B-57 on the emergency airstrip. Since the plane was not in serious trouble and could be landed safely, the pilot had asked permission to land on the main runway so that he and Paul could get back on station for the test. Having followed orders to land on the emergency strip, the pilot immediately radioed for permission to take off and land on the main strip. This angered the general, especially since he had already dispatched a van to take the pilot and me to a waiting plane."

After hearing Paul's story, I called the general and asked if I could meet him face-to-face to discuss the matter. He said yes, and our meeting was scheduled. Before our meeting, a most amazing event occurred. The pilot in question was taking off from Johnston Island in a B-57 when one of the jet's engines quit at the point of no return. The pilot, against all odds, managed to get the plane into the air, turn around, and land it safely. It was a feat that was not considered humanly possible. When I met with the general, I asked him if he had heard about the pilot's skill in making a one-engine takeoff and landing. The general had, and the feat had become the talk of the Task Force. "Well," I said, "I recommend that you put the pilot in for a medal." The general agreed and decorated the pilot with the Distinguished Flying Cross. I congratulated him on his decision.

Soon the time came to make our second attempt to carry out our Chama test. This time, however, there were many concerned faces among the military officers because of the ongoing Cuban Missile Crisis. Some wondered if we were going to war with the Soviet Union. I said, I did not think so. Kennedy would find a way to end the crisis, which he did with the naval blockade. Some of the military personnel were not convinced as we took off.

We took off from Hickman on October 18, 1962, and headed toward Johnston Island. All instruments were working and the bomb was dropped as scheduled. We recorded "good" data and reported an energy release of approximately 1.6 megatons. Chama, a new design aimed at

increasing energy release per unit of weight, was a success. Chama was, for me the last atmospheric shot I witnessed. Dominic and the era of big bangs, was over for me.



**Chama**

After Chama, life in Honolulu was dull and routine. I was sad because I realized that I would not fly with my friend, the general, again, nor ever see a nuclear explosion again. At our Ohohia Street office I wrote my “JTF-8 TU 8.1.1 Commanders Report.” It took me a few weeks to write since I had to gather data and perform a number of hand calculations. The tedium of writing was interrupted when my four-drawer safe arrived at Hickman. I sent my secretary over to claim it and arrange for its transfer to our office. Not long after my secretary left, I received a call from the customs office. My safe had been loaded on a truck and was on its way; however, my secretary had been detained. I was told by a low level official that the safe had to be returned before my secretary would be released. I immediately told the customs official that if my secretary was not released immediately, I would file kidnapping charges. This low-level official put his boss on the line. My threat must have worked, because my secretary was immediately released.

The issue, apparently, stemmed from a safe from Christmas Island that the Customs people had accidentally dropped, breaking a number of whiskey bottles. Since my safe came from Christmas Island, it was suspect and the Customs people wanted to open and inspect it. Since my

safe contained classified documents, I could not allow it to be opened at the Customs Office. I offered to open it at our office and allow a senior customs official to verify that the safe only contained paper documents. Ultimately, the Customs official decided to forget the whole matter.

My writing tedium also received a reprieve from Tracy, who was taking Hula lessons. She had become acquainted with a group of native performers who performed at the beach hotels. They gave Tracy dancing lessons and outfitted her with the appropriate costume – a grass shirt, flowers, and a head dress – and she danced in a couple of their shows. After one performance, Tracy asked if I heard the choreographer shout a native word at the dancers. I had and told Tracy I assumed he was reminding them of the lyrics. She said, “No. He was telling us to smile.”

Finally, I finished my report, which the Los Alamos classification people deemed to be Top Secret. This was a problem because the document would have to be shipped to Los Alamos under armed guard. My classification advisor told me to break my report into two volumes, thereby making each volume only Secret. The Task Force security officer told me to that each volume could be sent to Los Alamos by way of courier of officer rank. I sent the first volume off by courier and decided to hand deliver the second volume myself.<sup>10</sup>

With my work completed, Rene, Tracy, and I booked passage to San Francisco on the SS Lurline. As it turned out, this was the last cruise of that ship. She was an American registered luxury liner that had, by this time, become a bit rusty and not all modern in her outfitting. She was, however, quite comfortable. After making port at the Embarcadero in San Francisco, we were able to immediately book a flight to Albuquerque. While riding to the airport in a taxi, we told Tracy, who was reading, that she could see San Francisco if she looked out of her window. She took a long look at Market Street and said, “Well, we are just passing through,” and then turned back to her book. In Albuquerque, we were met by an armed guard from Los Alamos who took Volume Two off my hands. At that point, for me, Operation Dominic was over.

Although Operation Dominic was complete, Washington directed that we maintain a “readiness to resume testing in the atmosphere.” That meant JTF-8 remained active. However, with no more tests being actively considered, I decided to leave the Task Force. Bill Ogle suggested that I become a group leader in the Test Division. I was flattered, but declined and requested to be assigned back to P Division. There, I became active in a proposal to build a major research facility, the Los Alamos Meson Physics Facility, or LAMPF. In fact, I even suggested the name. Designing and planning the LAMPF was stimulating and fun. However, Rene’s physical condition began to deteriorate, and I took a job with a small research company in Pasadena so that we would be close to superior medical facilities. Despite the best medical care we could find, Rene passed away a couple of years later.

At that point, I wondered it was worth my effort to go on, but eventually I decided that I would provide for Tracy in the best possible manner. Subsequently, I took a job with an Air Force contractor, also located in California, as an analyst and designer on the Minute Man

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<sup>10</sup> **Preliminary Report of Task Unit 8.1.1 on Christmas Island Portion of Operation Dominic** (LA-02739-MS) and **Preliminary Report of Task Unit 8.1.1 on Christmas Island Portion of Operation Dominic** (LA-02739-MS Supplement). Also, **Chama Test of Follow-On portion of Operation Dominic** (LA-02804-MS).

Intercontinental Ballistic Missile Program. There were nearly a thousand Minute Man missiles and it was my job to oversee improvements to them. The USSR also had comparable missiles. Both the US and the USSR had the capability to inflict serious damage. The Minute Man improvements of most concern to me had to do with “hardening” the missiles against radiation from a Soviet attack carried out in and above the atmosphere.

Overall, our stay in California did not go well for either Tracy or me. When an old associate, Harold Agnew, became the director of Los Alamos, I petitioned him for a job. He offered me a position on his staff. I accepted with glee and returned to New Mexico. For the next ten years my job was to raise money for new projects outside the scope of the Department of Energy. I edited and completed proposals, signed off on behalf of the Laboratory, and acted as a liaison between the lab and prospective sponsors.

This job often required me to travel to Washington. On one visit, I went to the Pentagon and looked up Dodd Starbird. He was now a Lieutenant General with a fancy office. This was my chance to settle the issue of which of us was taller. On entering his office, I closed the door and said, “Come over here and stand back-to-back with me and see who is taller.” We did, each of us putting a hand on both our heads. It was a draw.

At home, my personal life improved greatly when a sweet lady named Marion agreed to marry me. Tracy, not only acquired a stepmother, but also two step-sisters, one older than her and one younger. Marion and I built a house on a two and one half acre lot with a bedroom for each of the girls. Life was good as I pushed paper and sold proposals. Then, Harold retired as Director of Los Alamos. I soon found that I could not support the policies of the new Director and, at the age of fifty, I retired from Los Alamos and started drawing income from my Laboratory pension. About this time, the girls had grown up and had gone off to college. When I accepted a job with a small company in La Jolla designing a device for controlling the burning of deuterium, Marion and I sold our house in Los Alamos, and Marion moved her real estate business to Santa Fe. Although such a gadget would never work, a private source was still willing to pay us to design, build, and test such a device. It was fun while it lasted.

In the early 1980s, President Ronald Reagan announced his “Space Defense Initiative (SDI),” known more popularly as “Star Wars.” SDI was to be a system of missile-launched interceptors to engage and destroy nuclear-tipped Soviet rockets. One did not have to be clever to see that the whole idea was preposterous. Soviet missiles could easily defeat such a system. All the Soviets had to do was to launch a number of rockets with dummy warheads, or live ones for that matter, in such numbers that would exhaust our defensive capabilities. In other words, for a fraction of the cost, the offense could overwhelm the defense.

SDI did have one redeeming feature – it provided jobs for scientists such as me. When a new Director came to Los Alamos in 1986, I moved back to New Mexico and began working again for Los Alamos, first as subcontractor and later as a consultant. Initially, I worked on an SDI project developing a kill mechanism that could be used on an interceptor rocket. I wrote the proposal and planning documents and later became the systems engineer. This work culminated in a test that we carried out at the White Sands Missile Range in Southern New Mexico. This test completed the Laboratory’s work on SDI projects.

With the completion of my SDI work, I looked around for other jobs at Los Alamos and found one, again, as a weapon tester. I joined a group that was developing the method and instruments to gather data from foreign nuclear explosions. At issue was how to verify that the Soviets were not violating the terms of the bi-lateral Threshold Test Ban Treaty that limited the yields of nuclear tests to no more than 150 kilotons. At the same time, another treaty, The Comprehensive Test Ban Treaty (CTBT), was being negotiated. One of the major CTBT issues was how to make sure that no country was conducting clandestine nuclear tests. President Reagan invoked an old Russian proverb to describe our task: “Trust, but verify.” My job was to develop the method of gathering data on the shock waves generated by a nuclear explosion and deriving the energy yield from such a test. By the time I started this work, the United States and the Soviet Union had already conducted two joint verification tests.<sup>11</sup>

In my new job, I traveled once again to the Nevada Test Site (NTS) to recover data gathered by the instruments I had helped develop. I also was the principal scientist who interpreted the data and wrote the reports. On my first visit, I was asked by a security official if I had ever been to the Site before. When I said “yes” and told him the date, he replied, “Wow, I was not even born then.”

On one of my visits, a Soviet team of scientists was present, monitoring with their own set of instruments. During this visit, they asked if they could tour an American city. So, we took them on a tour of Las Vegas (Soviet travel was governed by State Department rules and Las Vegas was the only city they had been authorized to visit.). They wanted to see a food market, and we obliged them by taking them to one. The Soviets were amazed and believed we had taken them to a specially built market to fool them. So, we took them to several more until they were convinced that our free enterprise system might really have some merit. One of the Soviets, who spoke respectable English said, “You know, we have a bunch of idiots in Moscow to please and you have a bunch of idiots in Washington. But here, in the field, we cooperate and get our data, don’t we?” Basically speaking, that is exactly what we did.

Many years later, in 2004, I visited Nagasaki, Japan, and ground zero for our Fat Man bomb dropped on August 9, 1945. The grass was green in the shallow depression caused by Fat Man’s shockwave. There also was a statue along with memorial stones bearing the names of those killed. In the “Peace Museum,” to my utter amazement, was a video recording showing Enrico Fermi at work in a lab in Los Alamos. To the Japanese, I suppose, he was a demon. Japan is now a very nice place and produces many of the consumer products used in the United States. Things have changed dramatically since I first went to sea in a World War II submarine.

Was Dominic worth the effort and cost? The tests we conducted at Christmas and Johnston Island underscored the potential for lethal and widespread damage. The atmospheric shots also contributed to the knowledge of nuclear weapons design and even the visual spectacle of what nuclear destruction might look like. I once discussed with Dodd Starbird the prospects for another series of atmospheric tests and whether or not I would choose to participate. “If you have to decide,” Starbird said, “you have to believe that there

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<sup>11</sup> Kearsarge, conducted at the Nevada Test Site on August 17, 1988, and Shagan, conducted at the Semipalatinsk Test Site on September 14, 1988.

is something to be gained by testing.” I did not quite appreciate Dodd’s comment at the time, but he, more than most, had thought about the future role of nuclear weapons in international relations. Would there be any value in another atmospheric test series? You decide.

## **Appendix A**

### **Megaton at a Microsecond**

The line near the lower surface of the sea. The images in front of the ball are atmospheric clouds.



## Appendix B

### The Ballads of Austin McGuire

(Poet Laureate of the Mid Pacific)

*RETURN TO LESTER S. HASKELL*

#### Welcome to Christmas Island

(Tune of Troop Ship)

I came down on a C-119,  
And the funniest thing that I have seen,  
Was a sergeant who marched up in British type shorts  
And said "Caution's required while engaging in sports."

"It's certain that you will come to grief  
If you are not careful out on the reef  
At all times maintain a diligent lookout  
For the huge ruddy sharks that are lurking about.

And if ever you are out in a boat  
It's doubtful you'll keep it afloat  
When the huge manta ray  
Leaps up out of the bay  
And you find out how hard you've been smote."

#### The Ballad of Christmas Island

(Original title of music unknown)

On a little coral island  
Down in the blue Pacific sea,  
I came to watch the Air Force dropping 50 bombs  
From 40,000 feet down close to me.

With my telescope and camera  
I photograph the burst within my shield,  
Then scrutinize the image in my record  
And write a memo telling of the yield.

Admirals, generals, and scientists  
And the Air Vice Marshal too  
They all sit in secret midnight briefings  
And pass the word of what we are going to do.

Now when I run into the Admiral  
The General and Air Vice Marshal too  
I pass to them my standard little message  
Saying, "Please Sir, is there nothing you can do?"

(Chorus) To get me off this ..... island  
Won't someone hear my plaintive cry  
Get me off this ..... island  
I want to go home eye and eye.

I tell my fellows in the mess hall  
I tell just anyone who is close to me  
Send TVs to the Army and the Navy  
Send the Air Force and the Chairman AFC.

(Chorus) Saying  
Get me off this ..... island  
Won't someone hear my plaintive cry  
Get me off this ..... island  
I want to go home eye and eye.

At night along the lonesome beaches  
Star out across the breakers foam  
I shout my little message to the Trade Winds  
Won't someone fix it so I can go home

(Chorus) Oh get me off this ..... island  
Won't someone hear my plaintive cry  
Get me off this ..... island  
I want to go home eye and eye.

#### Safety First

(Tune of Don't Sit Under the Apple Tree)

When you hear Mahsima shouting  
Early in the morn,  
Piping on the horn,  
Dark glasses must be worn  
When you see that mushroom cloud  
Coming rising from the sea.  
Take this advice from me.

(Chorus) Don't stand under the coconut tree  
When the blast wave gets up here,  
Stand out in the clear,  
With your finger in your ear.

No, no,  
It's exploding, when a falling  
Engulfed sphere  
Lands behind your ear.

(Break) I just got word from a guy who heard  
From the Base Dispensary  
They picked up a case with a dark blue face  
From underneath a coconut tree.

Suspicious  
Don't stand under the coconut tree  
When the blast wave gets up here  
Stand out in the clear  
With your finger in your ear

No, no  
That's the best advice we've had  
From all the long career  
Of our Safety Engineer.

#### The Saga of Johnston Island

(Tune of Manana)

West of Honolulu there's an island low and small  
It's so bloody low but it's mostly there at all  
It has a camp and airstrip and a rocket launching pad  
And if more space is needed it will be just too damn bad.

We launched a rocket nicely  
And it went up in the air  
And suddenly the radar couldn't find it anywhere  
The CP issued orders to turn on the radar pads  
A careful search revealed there just wasn't any there.

Destroy it, destroy it  
We don't know where that little mother went  
Destroy it, destroy it  
Can't take a chance, the orbit might be bent.

We saw a little fire out there on the launching pad  
Another search revealed that's the only pad we had  
Now all those extra rockets  
That accidentally landed away  
We'll have to wait 'till we rebuild  
To shoot another dev.

We messaged to the President  
"here's been a small delay  
He responded back, "My goodness, you were going to shoot  
in May."

The budget keeps increasing with every passing day  
It may delay me but out if you keep it up this way."

Destroy it, destroy it  
We don't know where that little mother went  
Destroy it, destroy it  
Can't take a chance, the orbit might be bent.