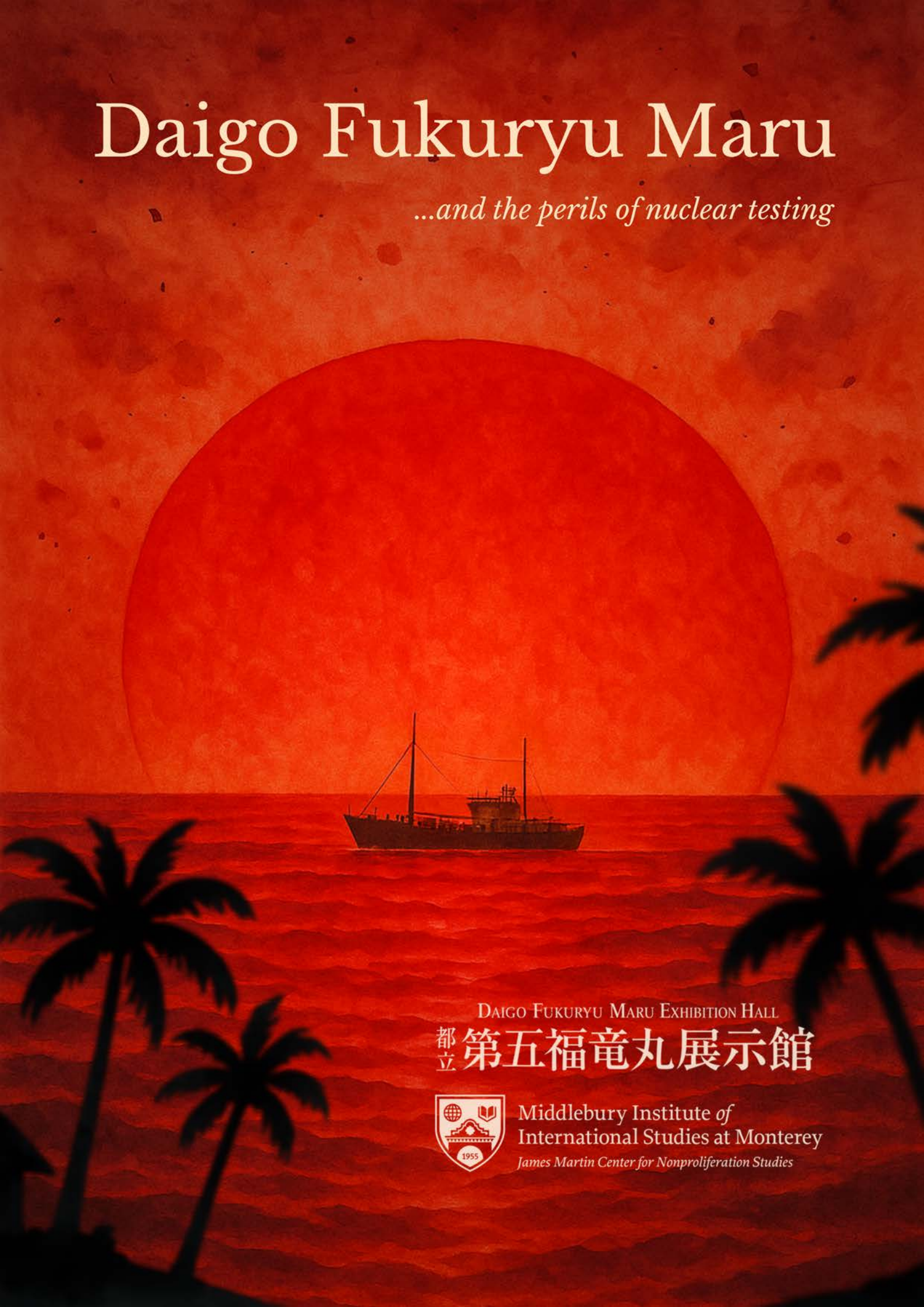
Daigo Fukuryu Maru

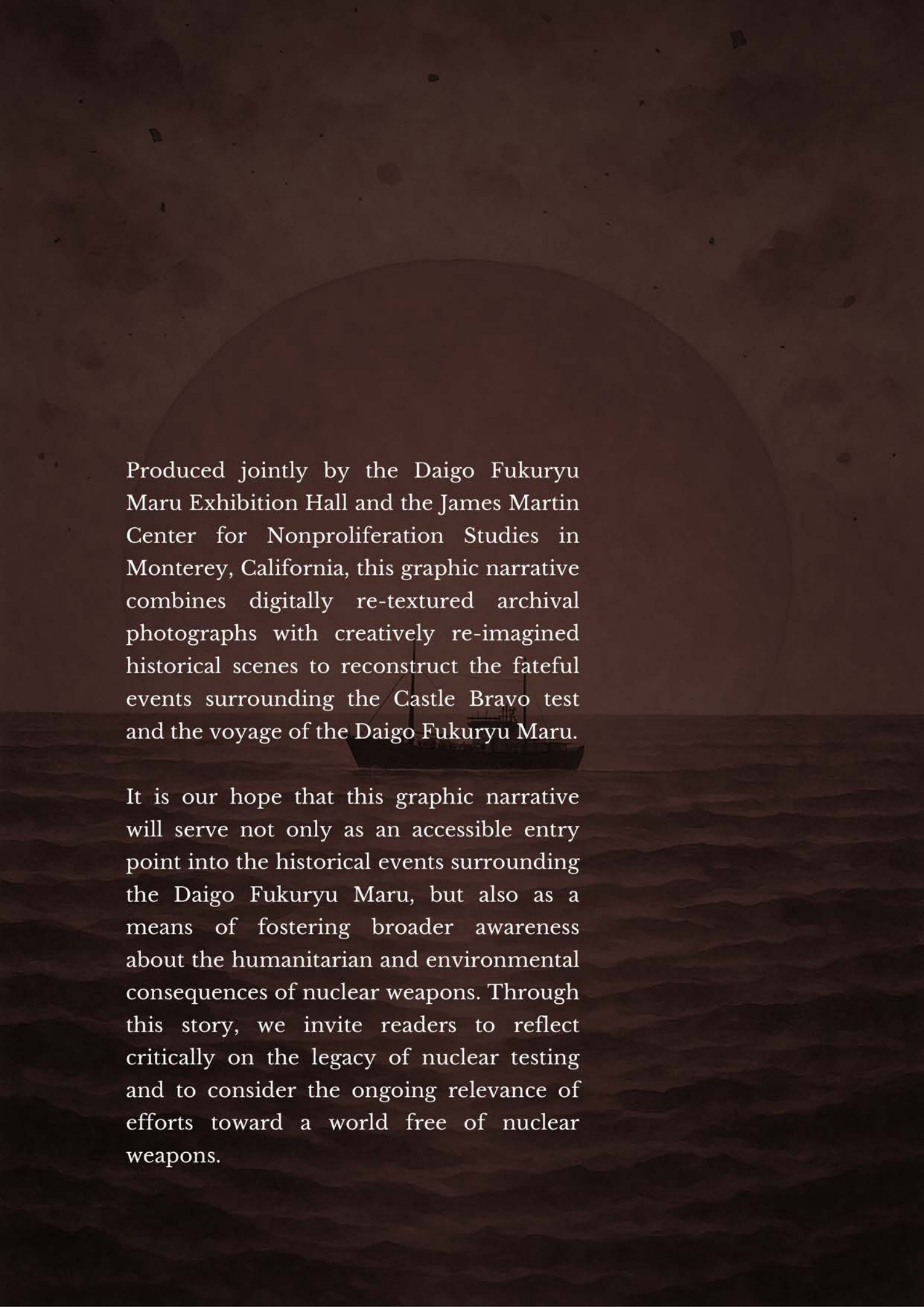
...and the perils of nuclear testing



DAIGO FUKURYU MARU EXHIBITION HALL

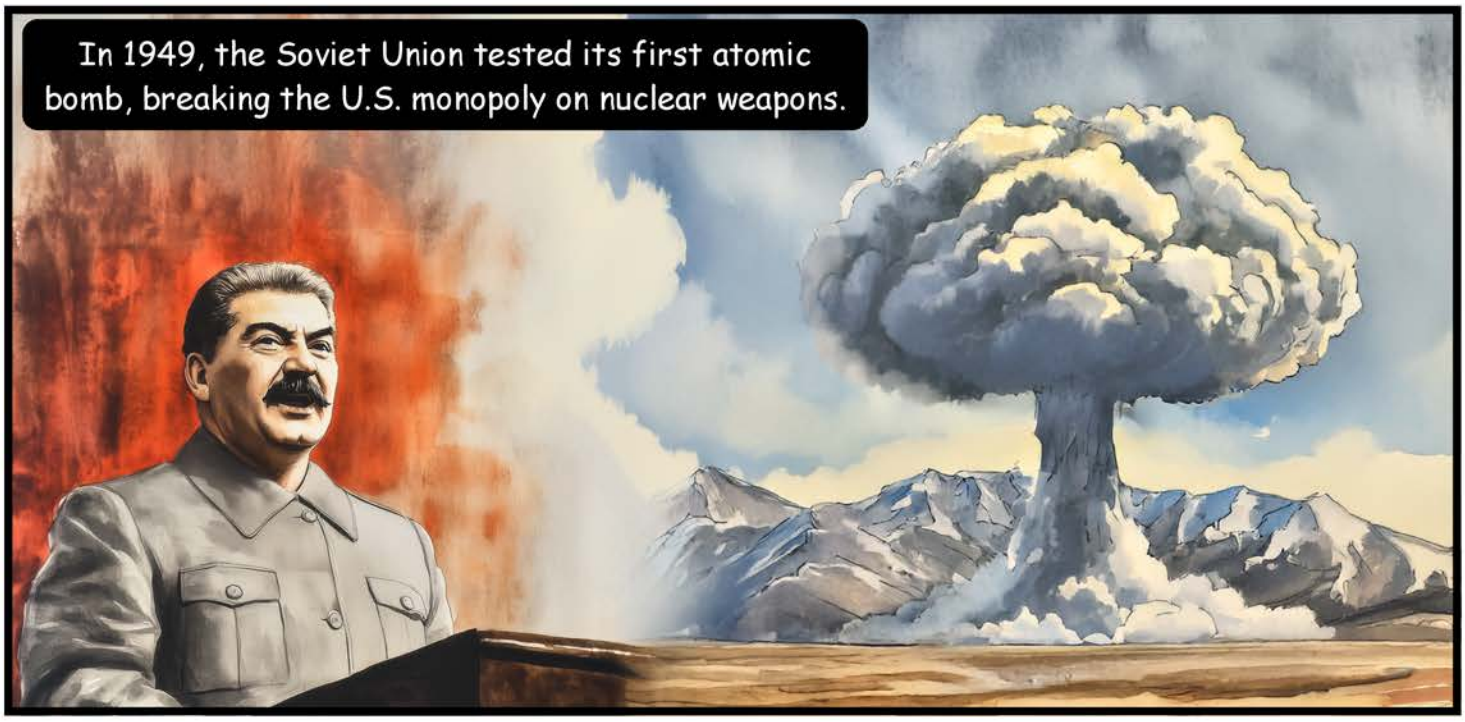
都立第五福竜丸展示館

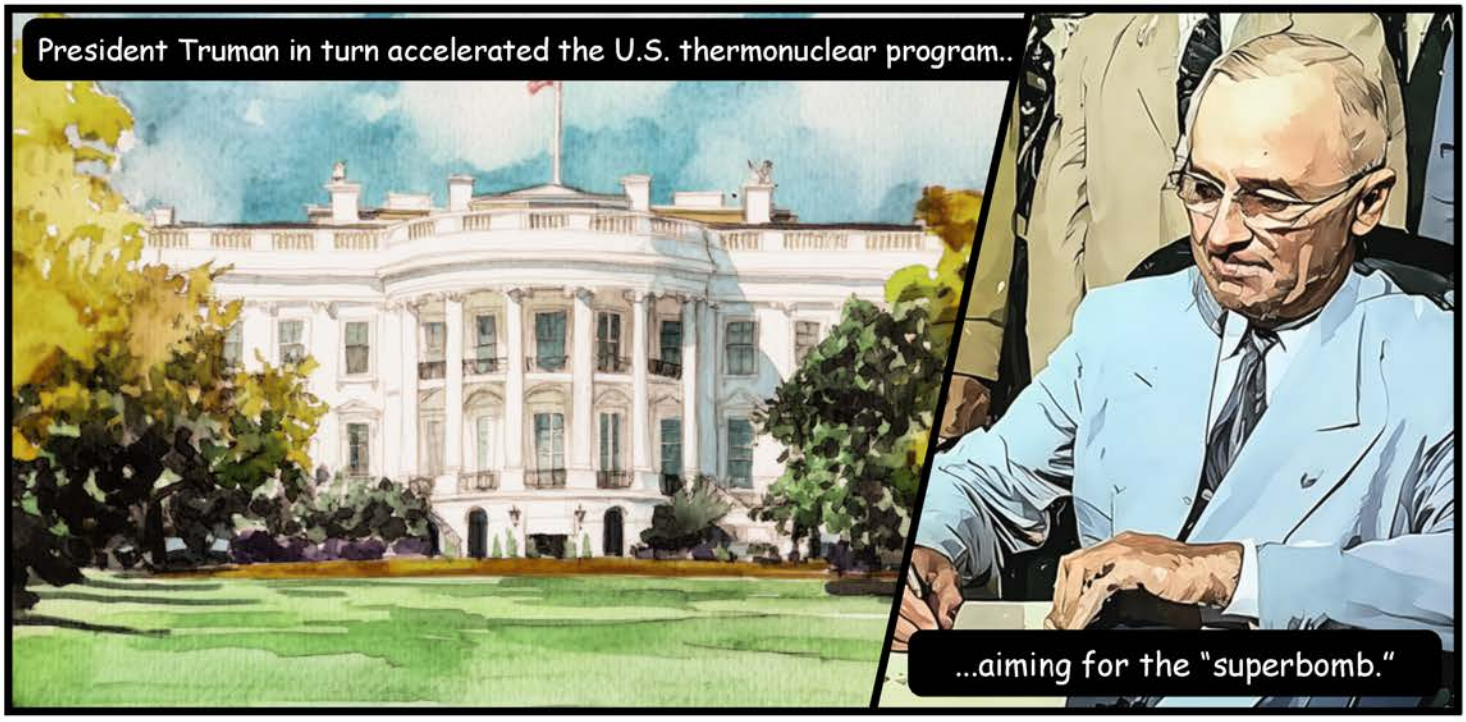
Middlebury Institute *of*
International Studies at Monterey
James Martin Center for Nonproliferation Studies

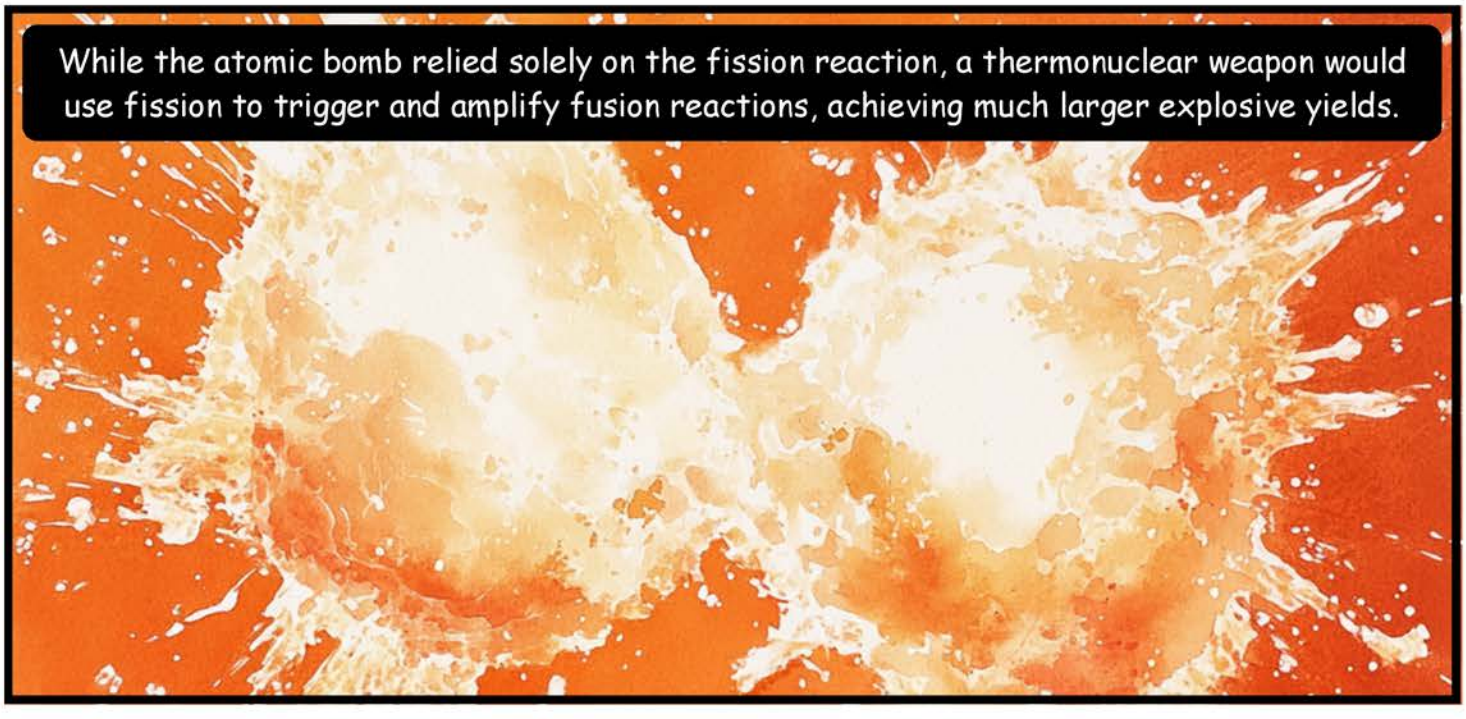


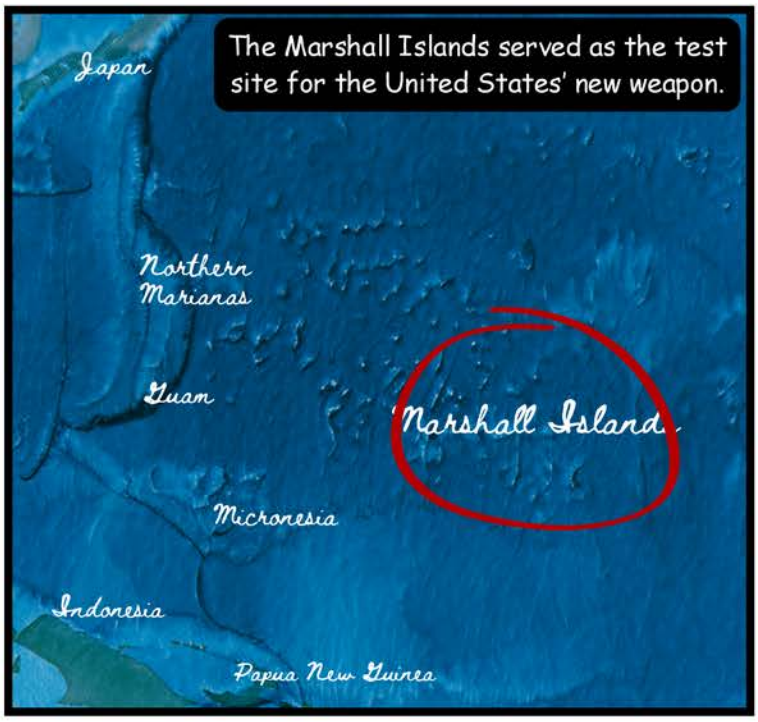
Produced jointly by the Daigo Fukuryu Maru Exhibition Hall and the James Martin Center for Nonproliferation Studies in Monterey, California, this graphic narrative combines digitally re-textured archival photographs with creatively re-imagined historical scenes to reconstruct the fateful events surrounding the Castle Bravo test and the voyage of the Daigo Fukuryu Maru.

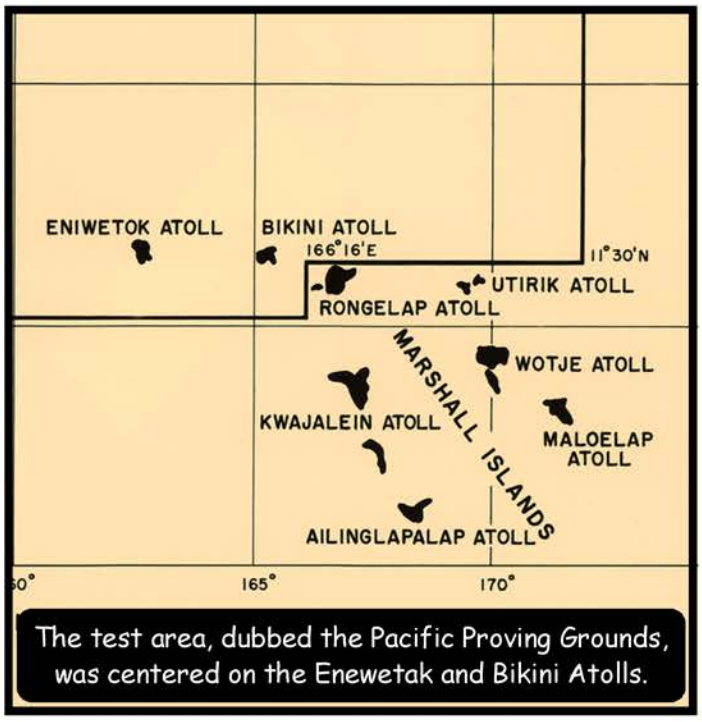
It is our hope that this graphic narrative will serve not only as an accessible entry point into the historical events surrounding the Daigo Fukuryu Maru, but also as a means of fostering broader awareness about the humanitarian and environmental consequences of nuclear weapons. Through this story, we invite readers to reflect critically on the legacy of nuclear testing and to consider the ongoing relevance of efforts toward a world free of nuclear weapons.

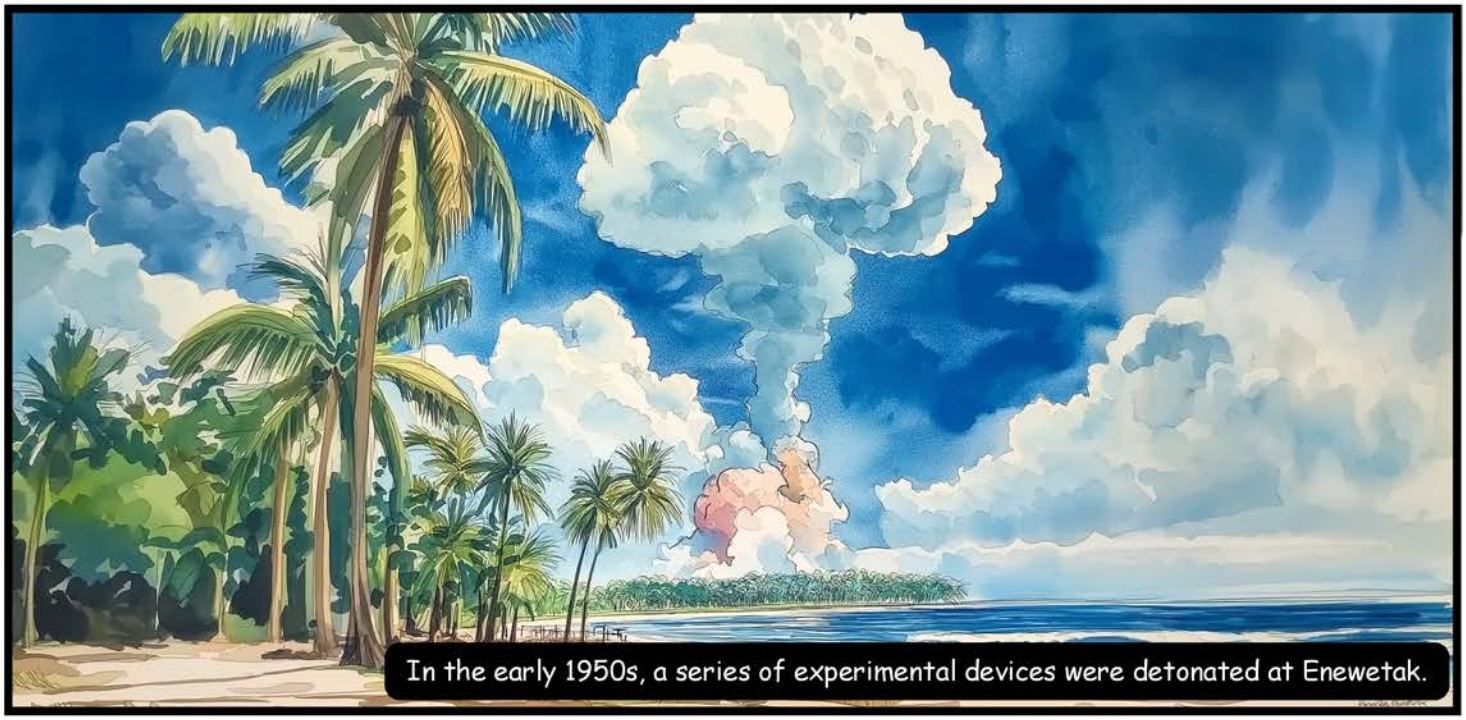

In 1949, the Soviet Union tested its first atomic bomb, breaking the U.S. monopoly on nuclear weapons.

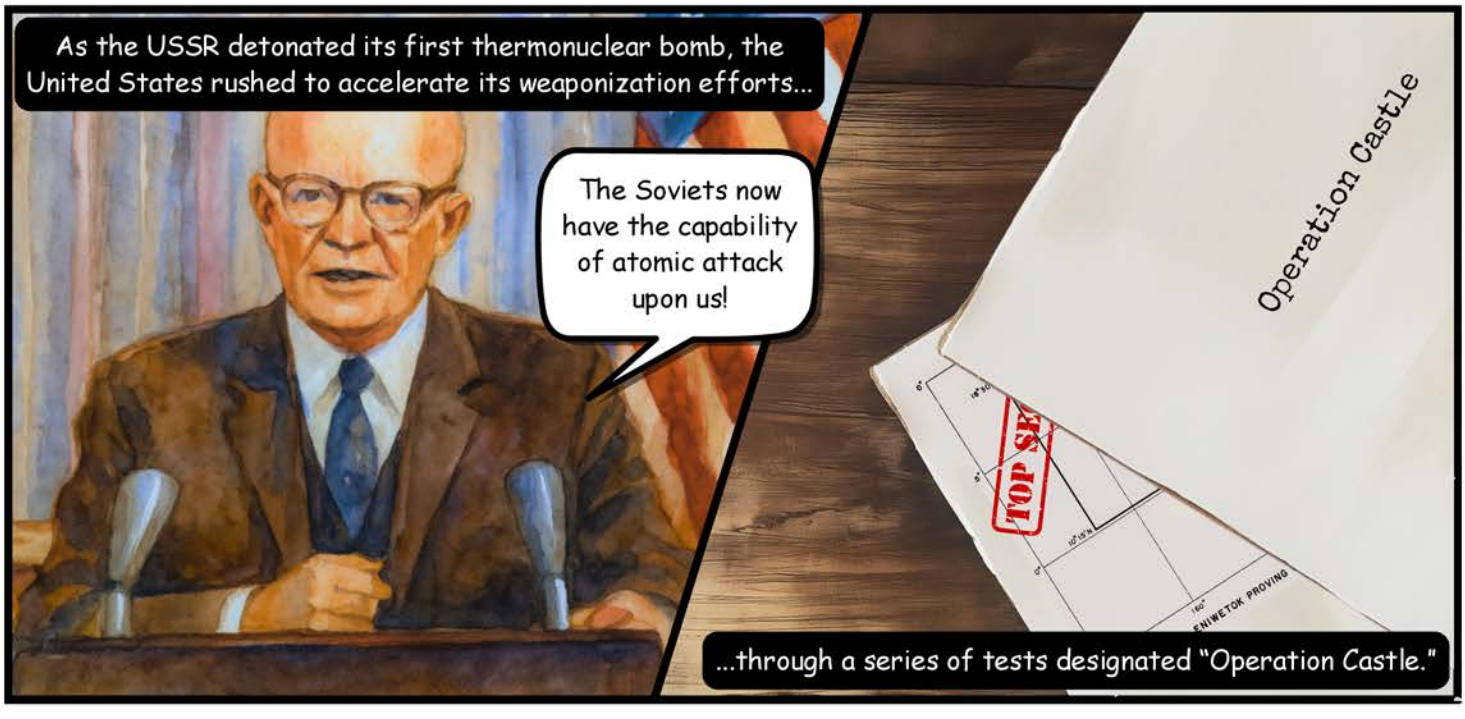

President Truman in turn accelerated the U.S. thermonuclear program..
...aiming for the "superbomb."


While the atomic bomb relied solely on the fission reaction, a thermonuclear weapon would use fission to trigger and amplify fusion reactions, achieving much larger explosive yields.

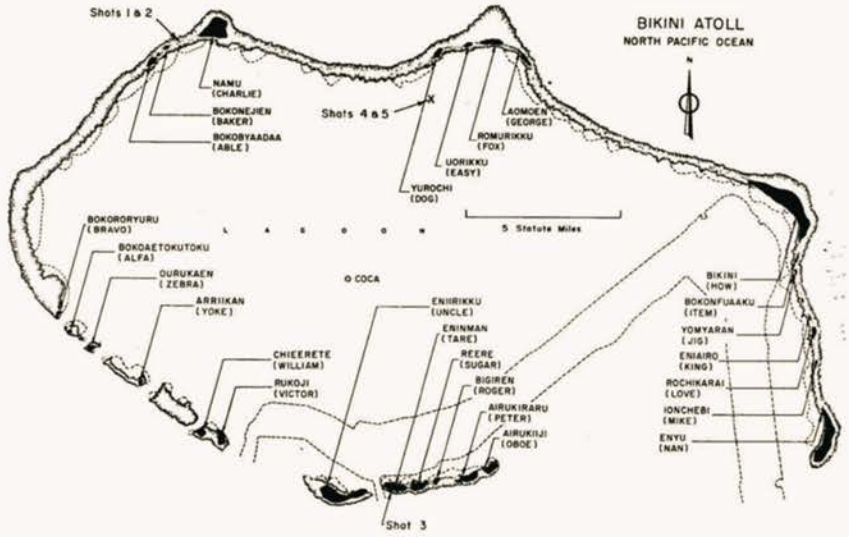

The Marshall Islands served as the test site for the United States' new weapon.
Japan
Northern Marianas
Guam
Marshall Islands
Micronesia
Indonesia
Papua New Guinea

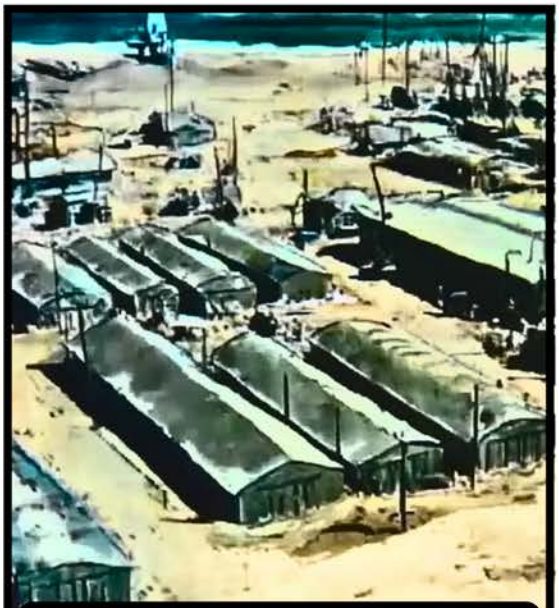

ENIWETOK ATOLL
BIKINI ATOLL
166°16'E
11°30'N
UTIRIK ATOLL
RONGELAP ATOLL
MARSHALL ISLANDS
WOTJE ATOLL
KWAJALEIN ATOLL
MALOELAP ATOLL
AILINGLAPALAP ATOLL
165°
170°
The test area, dubbed the Pacific Proving Grounds, was centered on the Enewetak and Bikini Atolls.


In the early 1950s, a series of experimental devices were detonated at Enewetak.


As the USSR detonated its first thermonuclear bomb, the United States rushed to accelerate its weaponization efforts...
The Soviets now have the capability of atomic attack upon us!
Operation Castle
TOP SE
ENIWETOK PROVING
...through a series of tests designated "Operation Castle."

It was decided that the Castle tests would take place at Bikini rather than the more remote Enewetak Atoll.





By 1953, a base camp had been built on Eninman Island, Bikini Atoll.

It was here that the explosive device for the Castle Bravo test was assembled - a thermonuclear device that would be the largest ever tested by the United States.

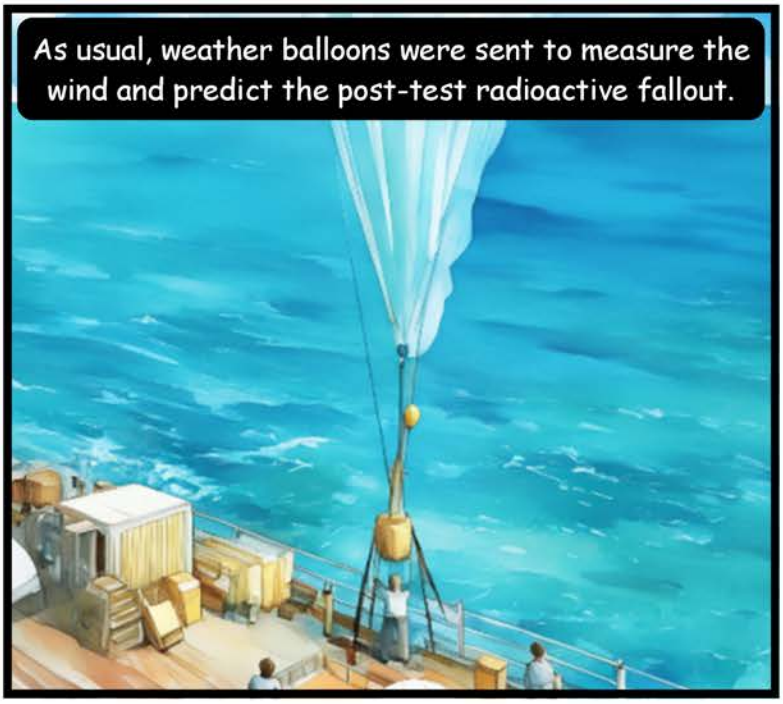
On February 20, 1954, the assembled thermonuclear device was delivered to a small artificial islet off Namu Island.

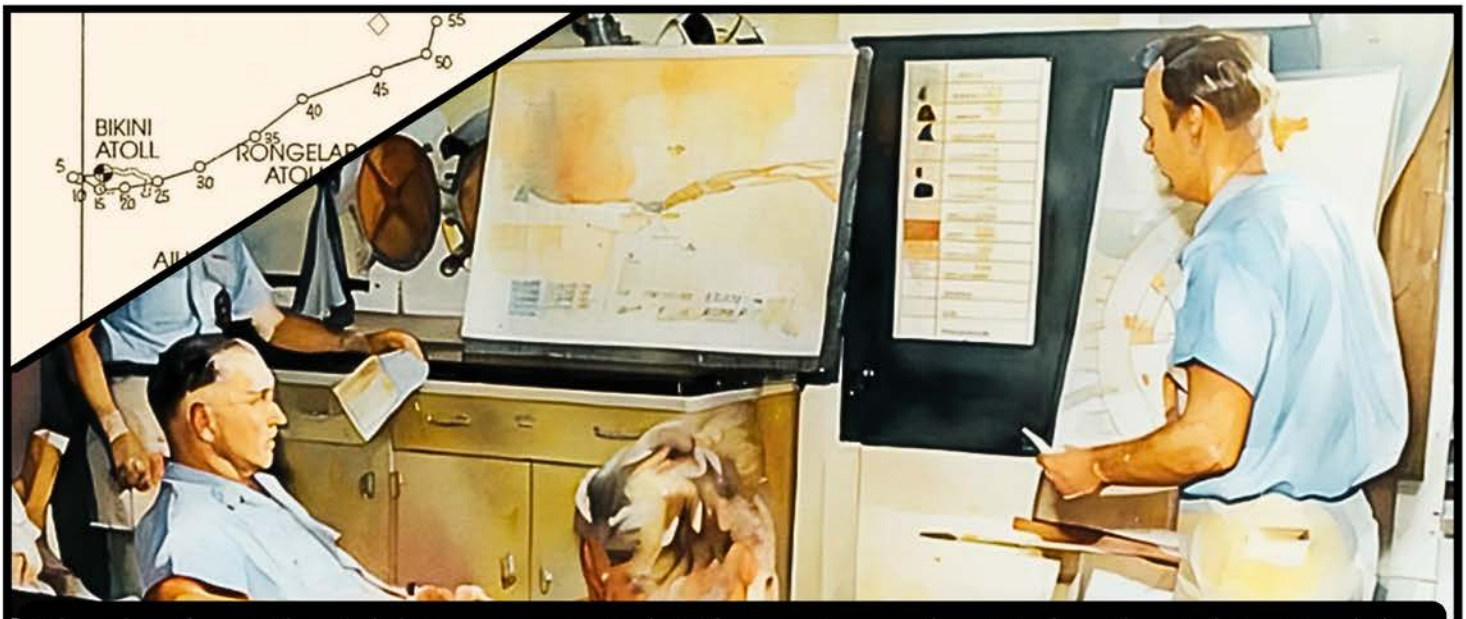
Over the coral reef, 12 columns stood with mirrors to reflect the first rays from the detonation.

Across the lagoon, a firing bunker was constructed on Enyu Island. Its walls were of reinforced concrete three feet thick, buried under ten feet of dirt and sand to shield against the radiation.

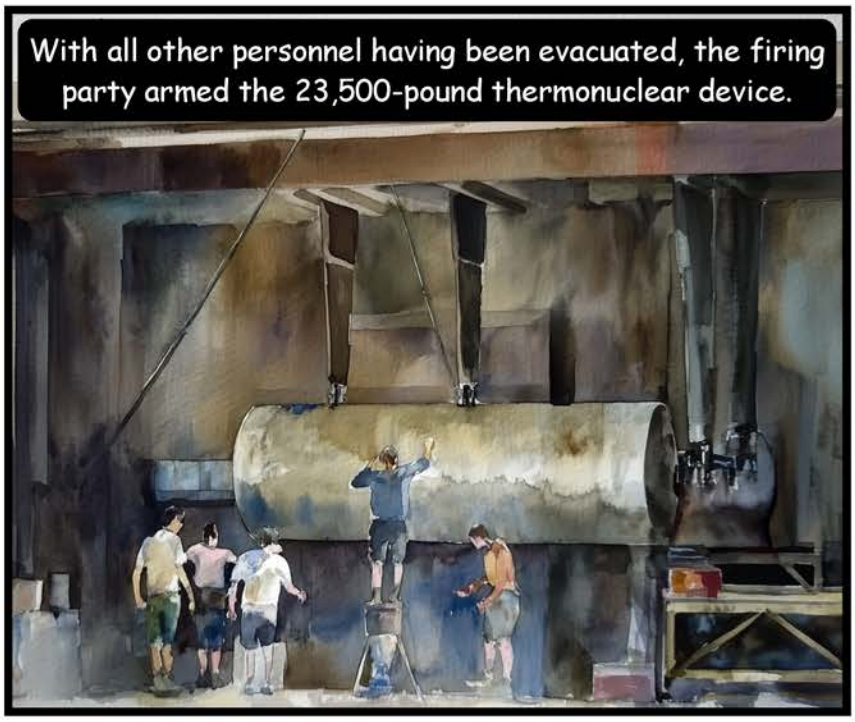
The day before the test, final preparations were underway...

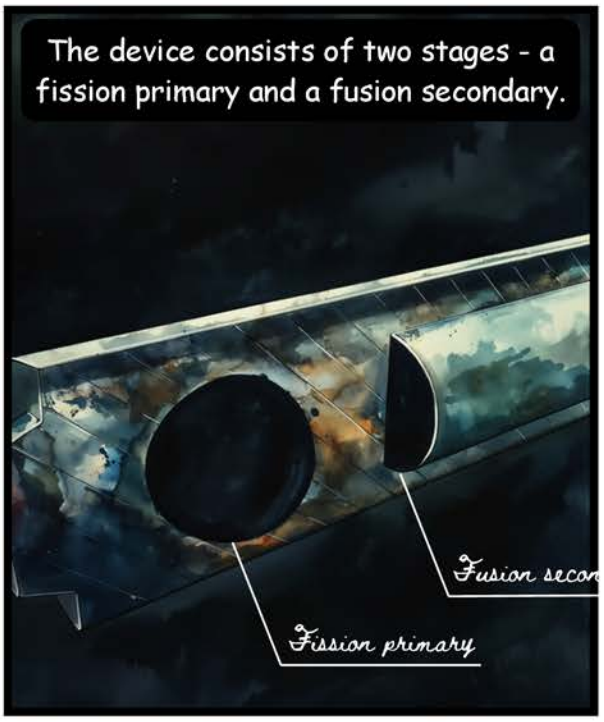
As usual, weather balloons were sent to measure the wind and predict the post-test radioactive fallout.

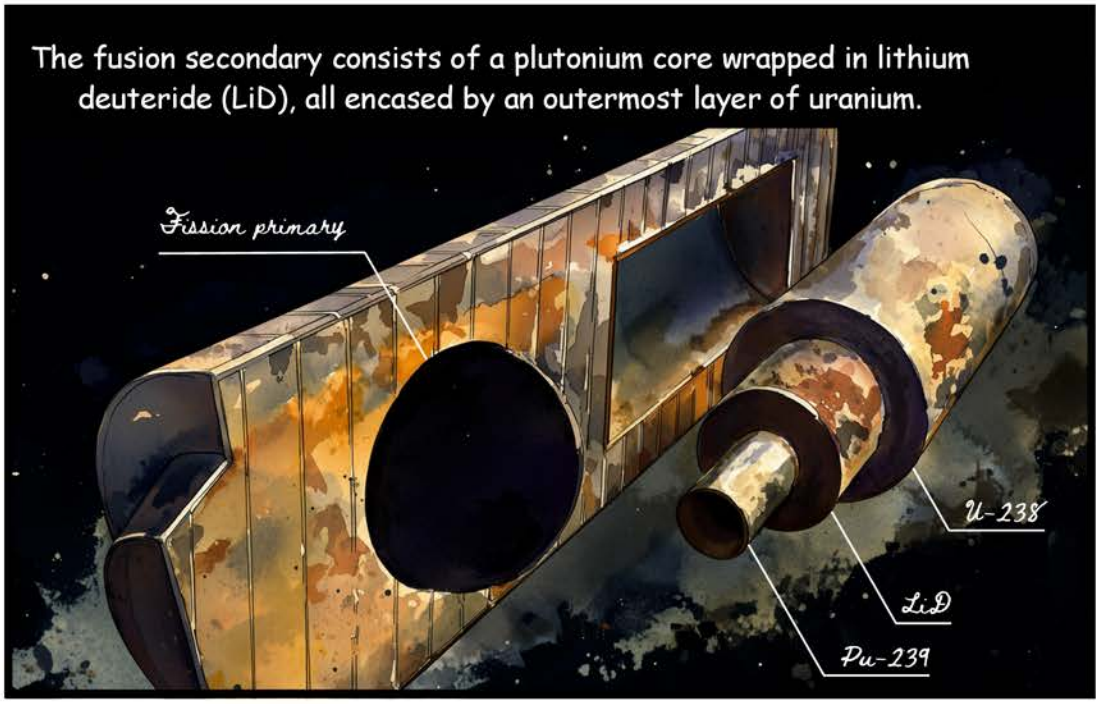




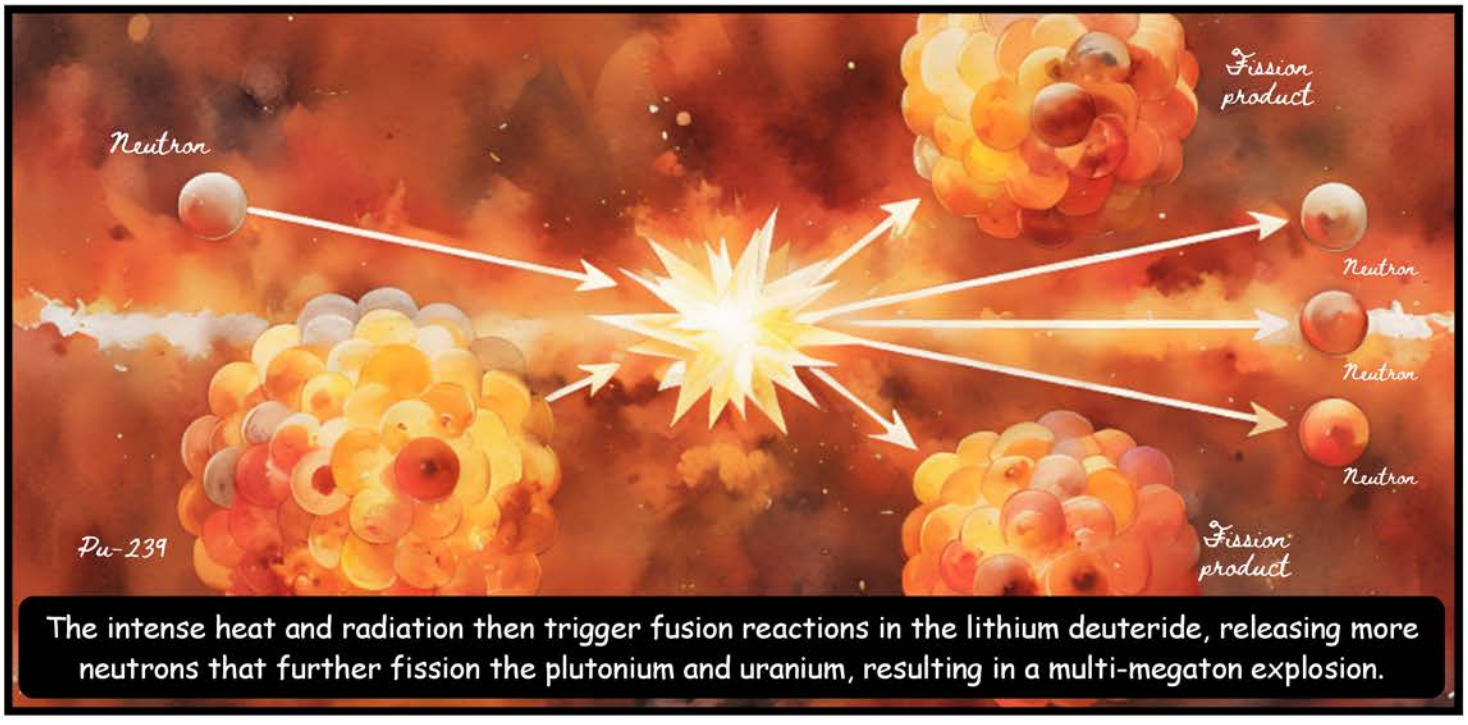
Though unfavorable wind data were reported at the evening weather briefing, it was determined that the speed of the wind was low, the risk was slight, and the test would proceed regardless.


With all other personnel having been evacuated, the firing party armed the 23,500-pound thermonuclear device.

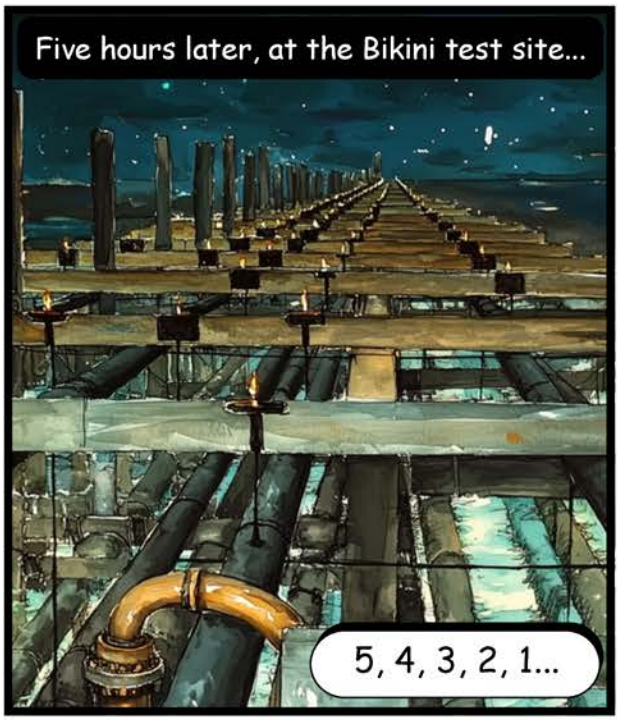

The device consists of two stages - a fission primary and a fusion secondary.
Fusion secon
Fission primary


The fusion secondary consists of a plutonium core wrapped in lithium deuteride (LiD), all encased by an outermost layer of uranium.
Fission primary
U-238
LiD
Pu-239

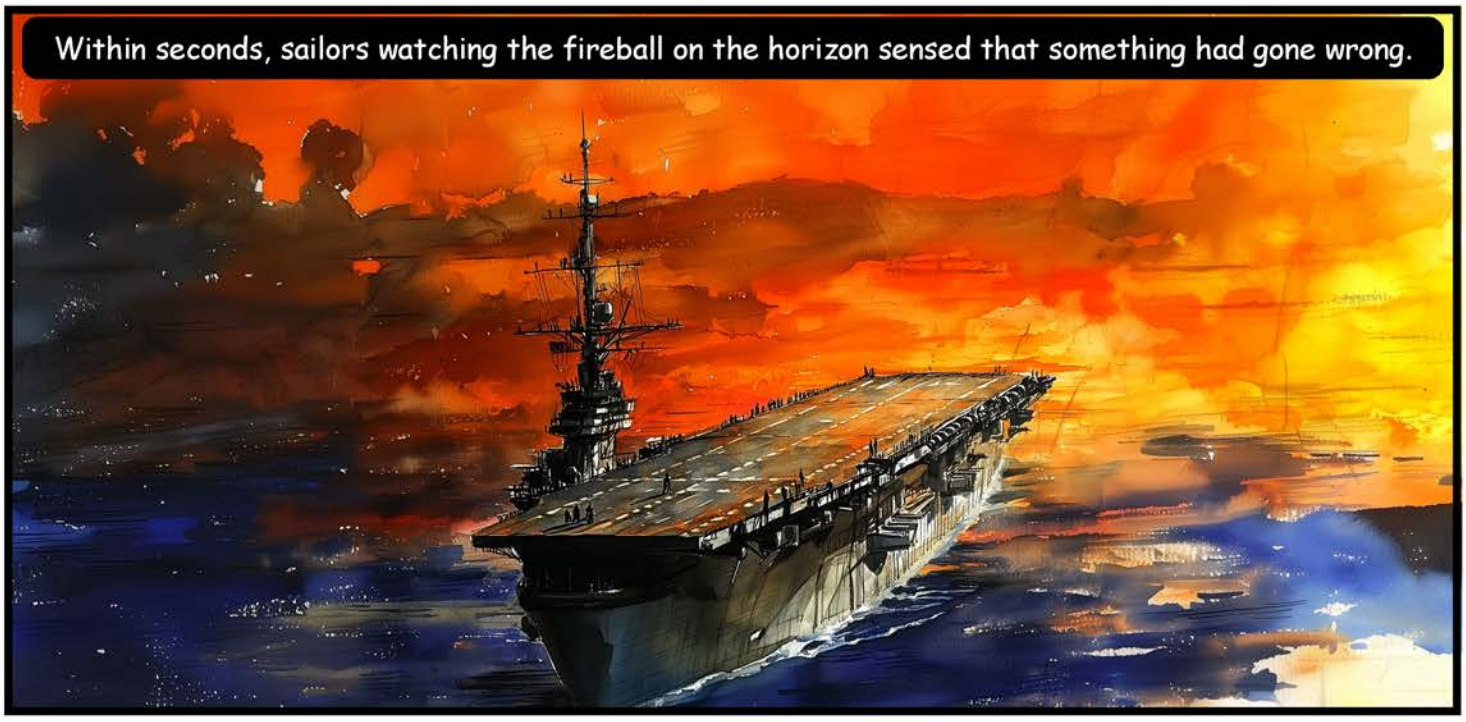

The fission primary detonates first.

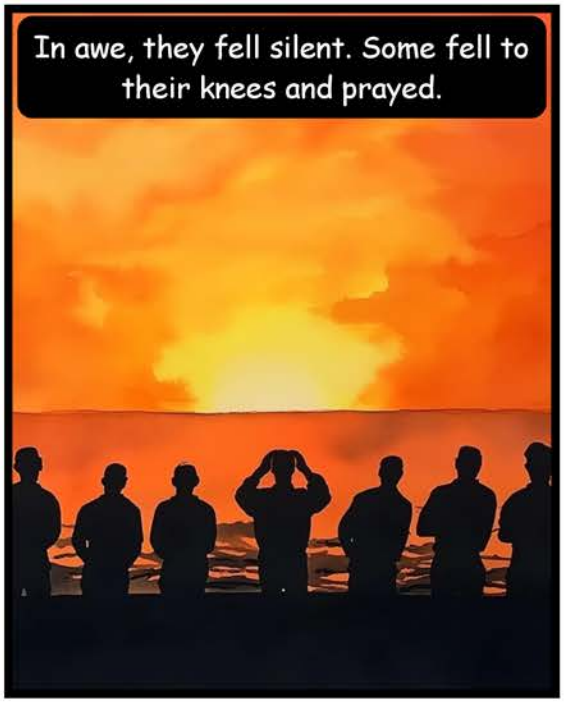

Neutron
Fission product
Neutron
Neutron
Neutron
Pu-239
Fission product
The intense heat and radiation then trigger fusion reactions in the lithium deuteride, releasing more neutrons that further fission the plutonium and uranium, resulting in a multi-megaton explosion.

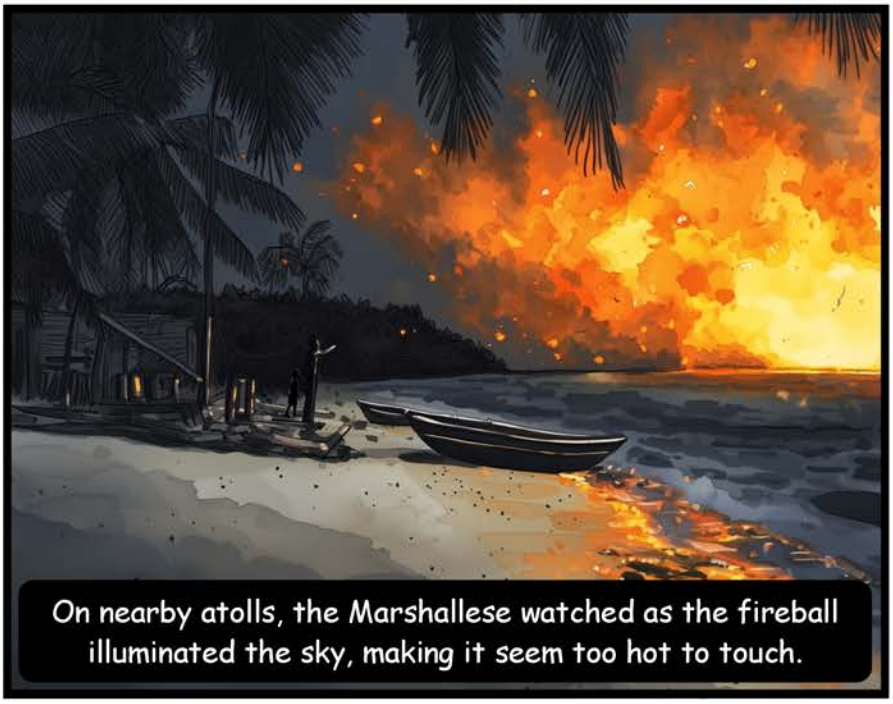

At 1:44am on March 1, 1954, the first observation aircraft took off from the Enewetak airstrip.

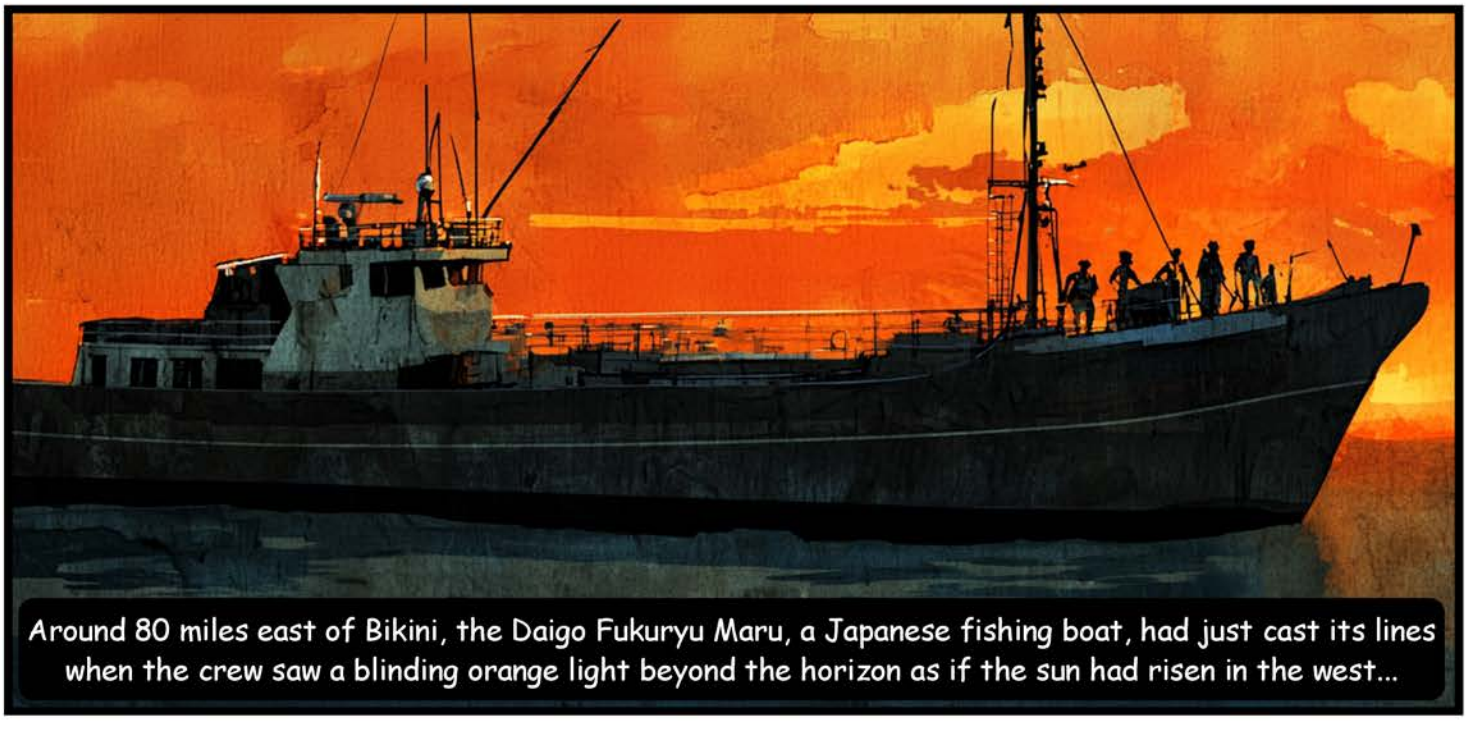

Five hours later, at the Bikini test site...
5, 4, 3, 2, 1...


The fireball, 4 miles in diameter, ascended at a rate of 1,000 ft per second. The mushroom cloud rose to over 114,000 ft, far into the stratosphere, sucking up 10 million tons of radioactive coral with it...


Within seconds, sailors watching the fireball on the horizon sensed that something had gone wrong.


In awe, they fell silent. Some fell to their knees and prayed.


On nearby atolls, the Marshallese watched as the fireball illuminated the sky, making it seem too hot to touch.


Around 80 miles east of Bikini, the Daigo Fukuryu Maru, a Japanese fishing boat, had just cast its lines when the crew saw a blinding orange light beyond the horizon as if the sun had risen in the west...

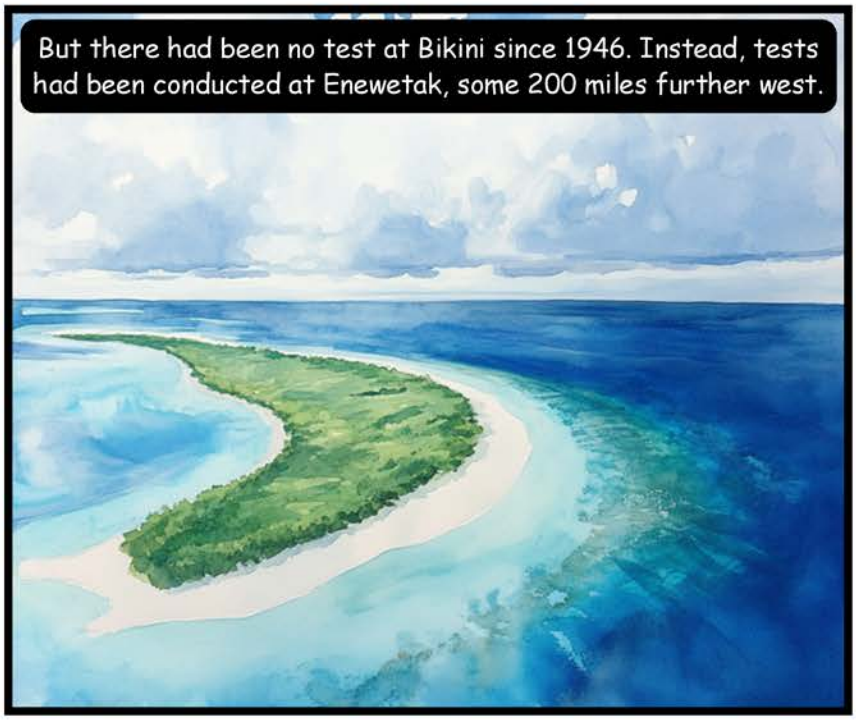
A longline tuna fishing boat, the Daigo Fukuryu Maru, or Lucky Dragon No. 5, left its home port of Yaizu on January 22, headed to the Midway Islands.

When they lost their main fishing line, the crew decided to turn south toward the Marshall Islands.

Some among the crew were aware of the United States' nuclear testing activities...

Be careful - that's where the United States has had its atom bomb tests!

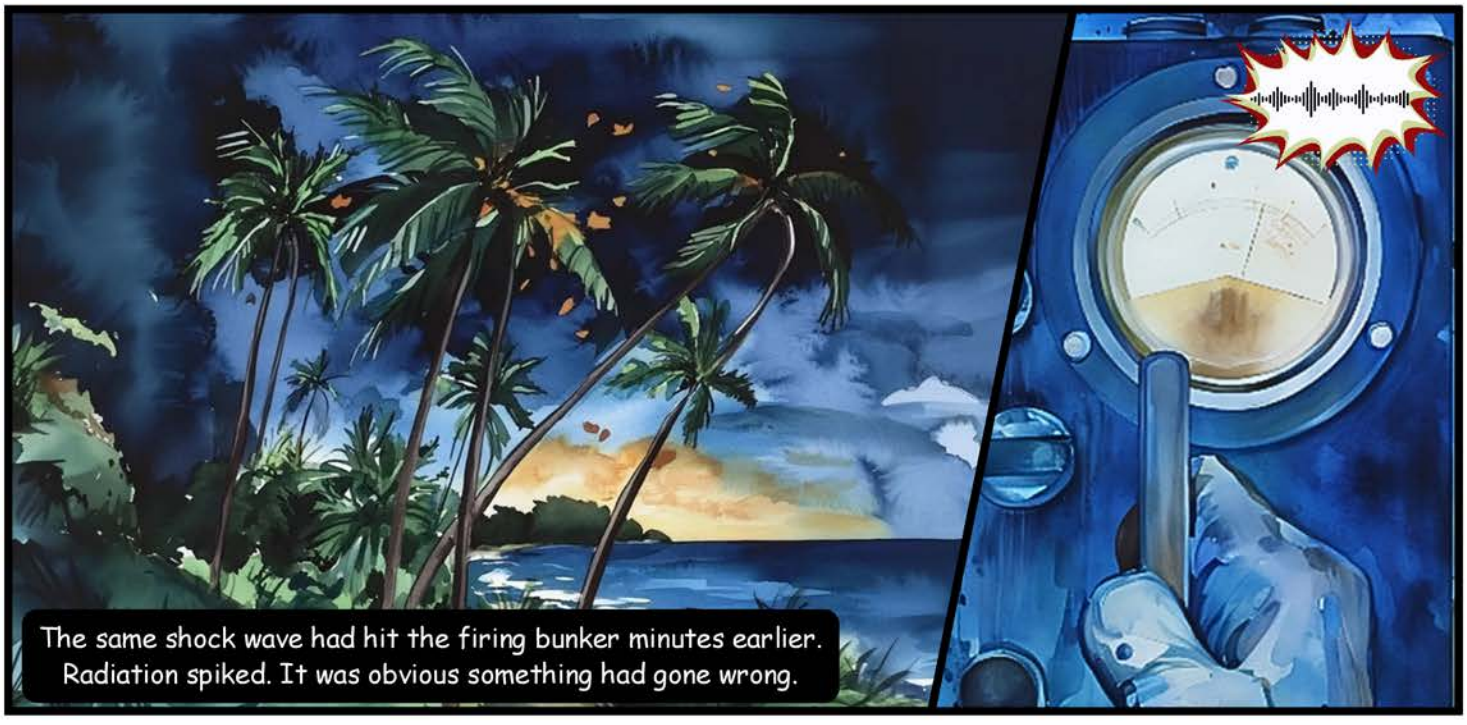
But there had been no test at Bikini since 1946. Instead, tests had been conducted at Enewetak, some 200 miles further west.



On the morning of March 1, the crew decided to throw the lines one last time.


Come look! The sun has risen in the west...
Is it...an atomic bomb?


Start up the engines!
Haul in the lines!
When the light faded, the shockwave arrived, making the whole boat tremble...


The same shock wave had hit the firing bunker minutes earlier. Radiation spiked. It was obvious something had gone wrong.

The scientists expected only 40% of the lithium to transform into fusion fuel in the instant detonation...

Lithium-7

Neutron

Lithium-6

Neutron

Lithium-6

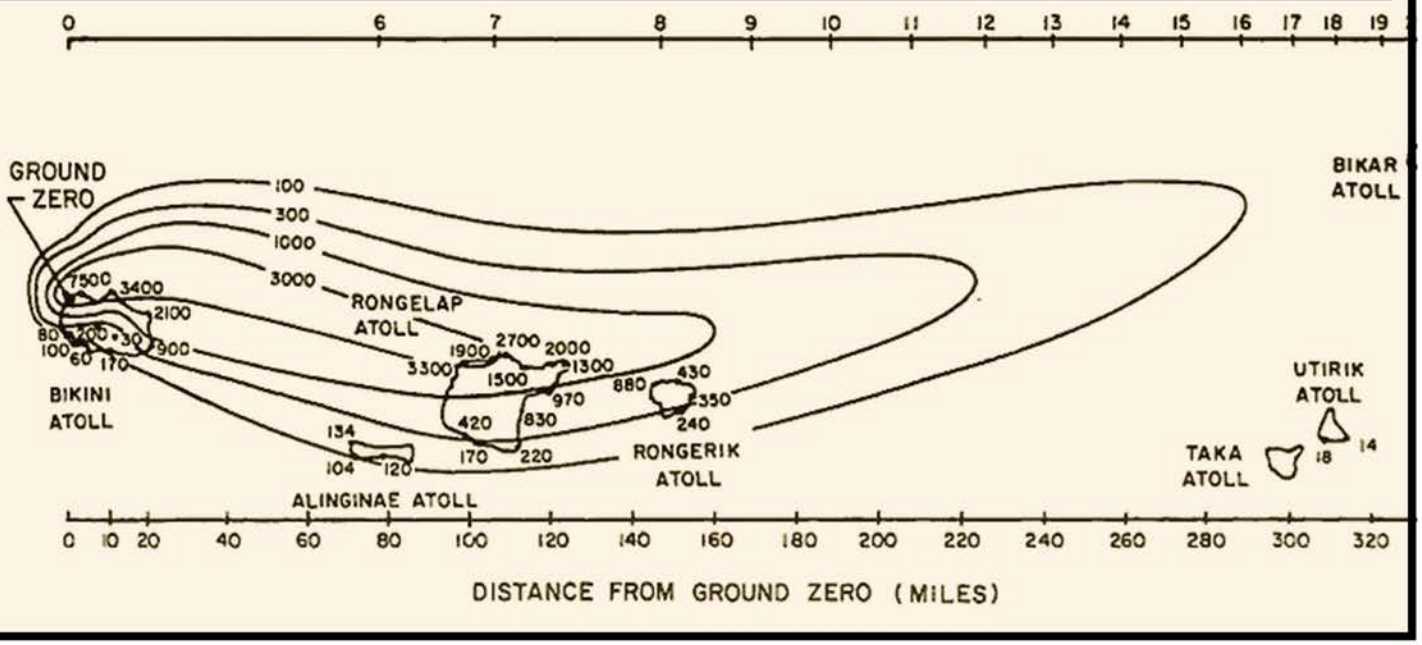
Neutron

That turned out to have been a gross underestimate.

Instead of the expected yield of 6-8 megatons, the Castle Bravo device gave off a 15-megaton explosion!

By daybreak, the pulverized reef coated with radioactive particles had begun falling - rather than being trapped in the stratosphere as scientists had mistakenly expected. The ash became known as "fallout."

Carried by the wind, the fallout spread hundreds of miles to the east, over the Marshall Islands' inhabited atolls.



On nearby atolls, the tiny particles coated the trees and roofs...

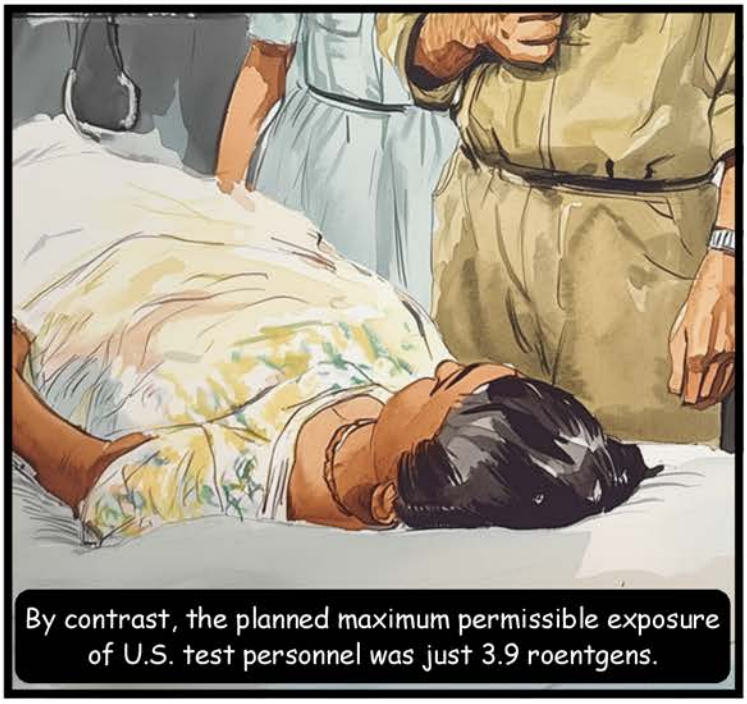
...sticking to the inhabitants' hair and skin.

A belated order was given to evacuate the villagers...

Although the taskforce had been warned about the possibility of fallout, no ship had been set aside for the evacuation operation.

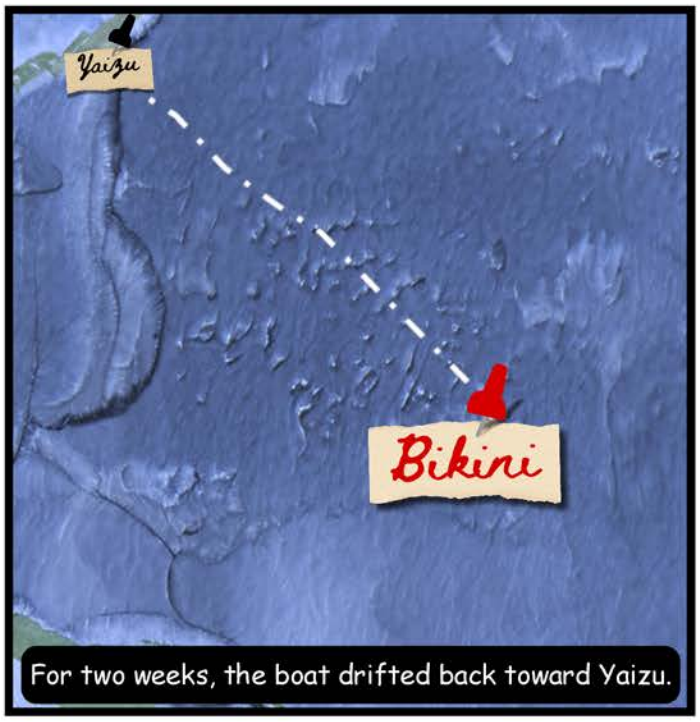

Two days passed before Navy vessels reached the nearby atolls.


By that time, the inhabitants were exhibiting symptoms of radiation sickness from an estimated gamma whole-body dose of 100-125 roentgens.


By contrast, the planned maximum permissible exposure of U.S. test personnel was just 3.9 roentgens.

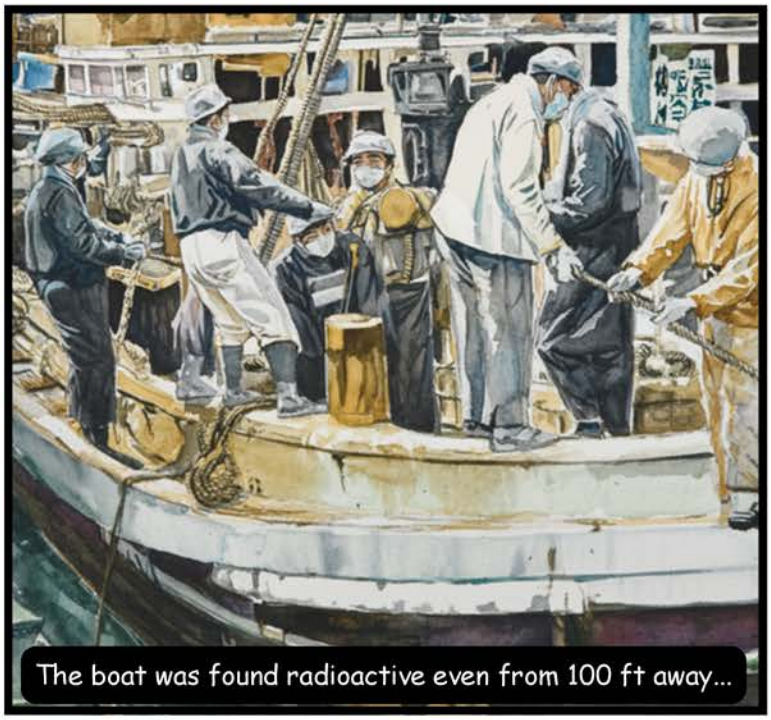

It was the same "death ash" that fell upon the Daigo Fukuryu Maru.
But there would be no rescue for her crew.

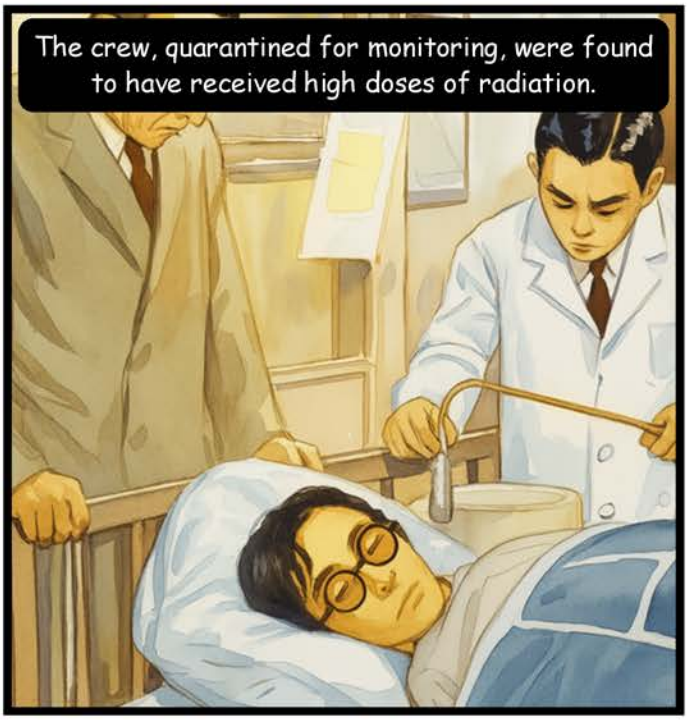

Sickness soon set in - nausea, headache, eye inflammation, and blisters where the skin was exposed.

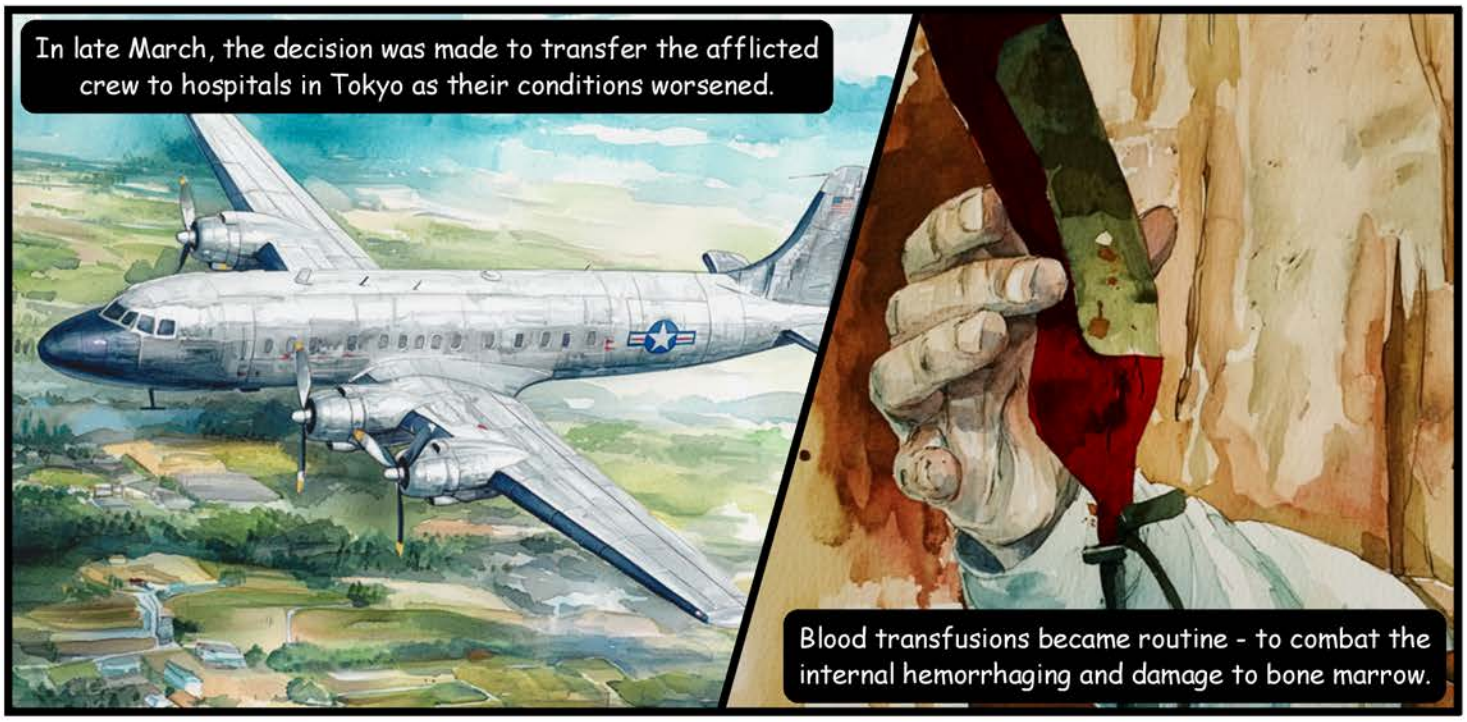

Yaizu
Bikini
For two weeks, the boat drifted back toward Yaizu.


It was only on March 14 that the Daigo Fukuryu Maru returned to her home port.

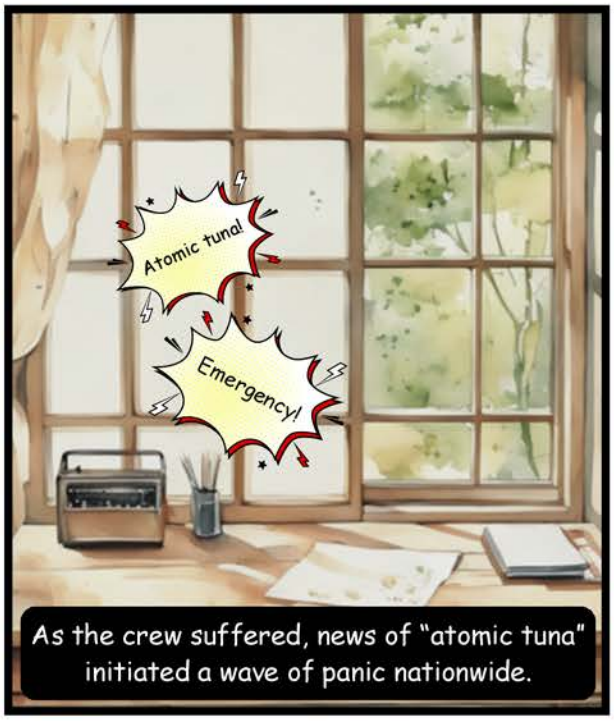

邦人漁夫ヒキニ原爆実験に遭遇
23名が原子病
Soon, the story broke in the press, and scientists from nearby cities were dispatched urgently to investigate.


The boat was found radioactive even from 100 ft away...


The crew, quarantined for monitoring, were found to have received high doses of radiation.

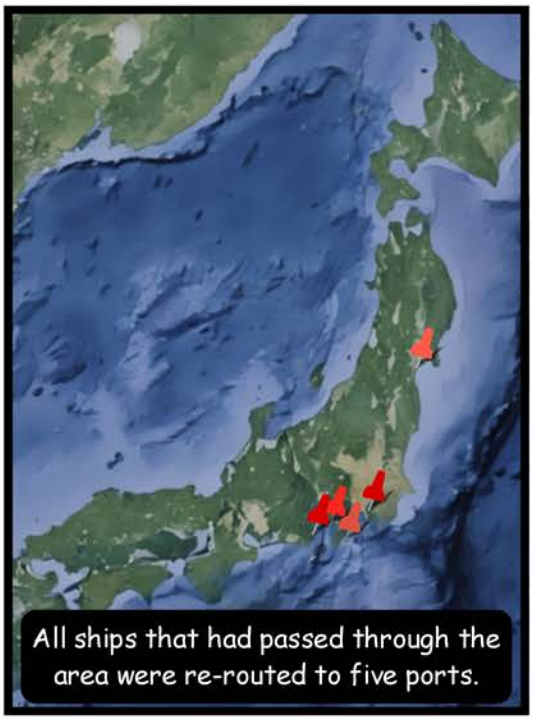

In late March, the decision was made to transfer the afflicted crew to hospitals in Tokyo as their conditions worsened.
Blood transfusions became routine - to combat the internal hemorrhaging and damage to bone marrow.


In late August, the condition of Aikichi Kuboyama, the Daigo Fukuryu Maru's radioman, began to sharply deteriorate. He would suffer for another month before succumbing to "acute radiation disease and its sequelae."


Atomic tuna!
Emergency!
As the crew suffered, news of "atomic tuna" initiated a wave of panic nationwide.


In days, contaminated fish had been sold to major cities across Japan - Tokyo, Nagoya, Kobe, Osaka, Kyoto...

Japanese health authorities ordered the inspection of all fish caught within 2,500 kilometers of the Pacific testing grounds.



All ships that had passed through the area were re-routed to five ports.

Dr. Yasushi Nishiwaki, a biophysics professor in Osaka, and his American wife, Jane, were among the first to take measurements of the contaminated fish.

The measurements were shocking - 2,000 counts per minute!

Detecting even higher counts on board the Daigo Fukuryu Maru and near her crew, Nishiwaki drafted an open letter to the U.S. Atomic Energy Commission demanding information about the fallout. The letter was dismissed.

AEC Chair Lewis Strauss publicly downplayed the incident and privately insinuated that the boat might have been a "Red spy ship."

Congressman W. Sterling Cole of the Joint Committee on Atomic Energy was reported implying the same.

An infuriated Japanese public and press demanded that the U.S. government reveal the nature of the "death ash," referring to the radioactive fallout, but that was a U.S. national security secret.

By July, contaminated fish had been reported at a California cannery, according to an official at the U.S. FDA.

But the information was withheld even from the American Embassy in Tokyo.

DATE: July 6, 1954

SUBJECT: Radioactive Tuna

PARTICIPANTS: Mr. Cribbett, Food and Drug Administration
Mr. Looney, U/FW

COPIES TO: S/AE - Mr. Spiegel
NA - Mr. Finn
U/FW - Mr. Herrington

Mr. Cribbett informed me that a radioactive tuna had been discovered ea today in a California cannery by the cannery's own monitoring group. This i the third contaminated tuna found among Japanese tuna exports to the United since the bomb tests of March. The fish, a thirty-five pound albacore, rece arrived from Yokohama on the Asama Maru; it was part of a lot of 1,406 fish, designated "White Tuji"; it had been taken from cold storage in Japan on May

Contamination was largely in the skull and bones, as in the case of the earlier two specimens, indicating contamination through ingestion. Radioact was from .6 to .8 milli-roentgens.

I indicated to Mr. Cribbett that the Department would watch developmen but would not at this time inform Embassy Tokyo.

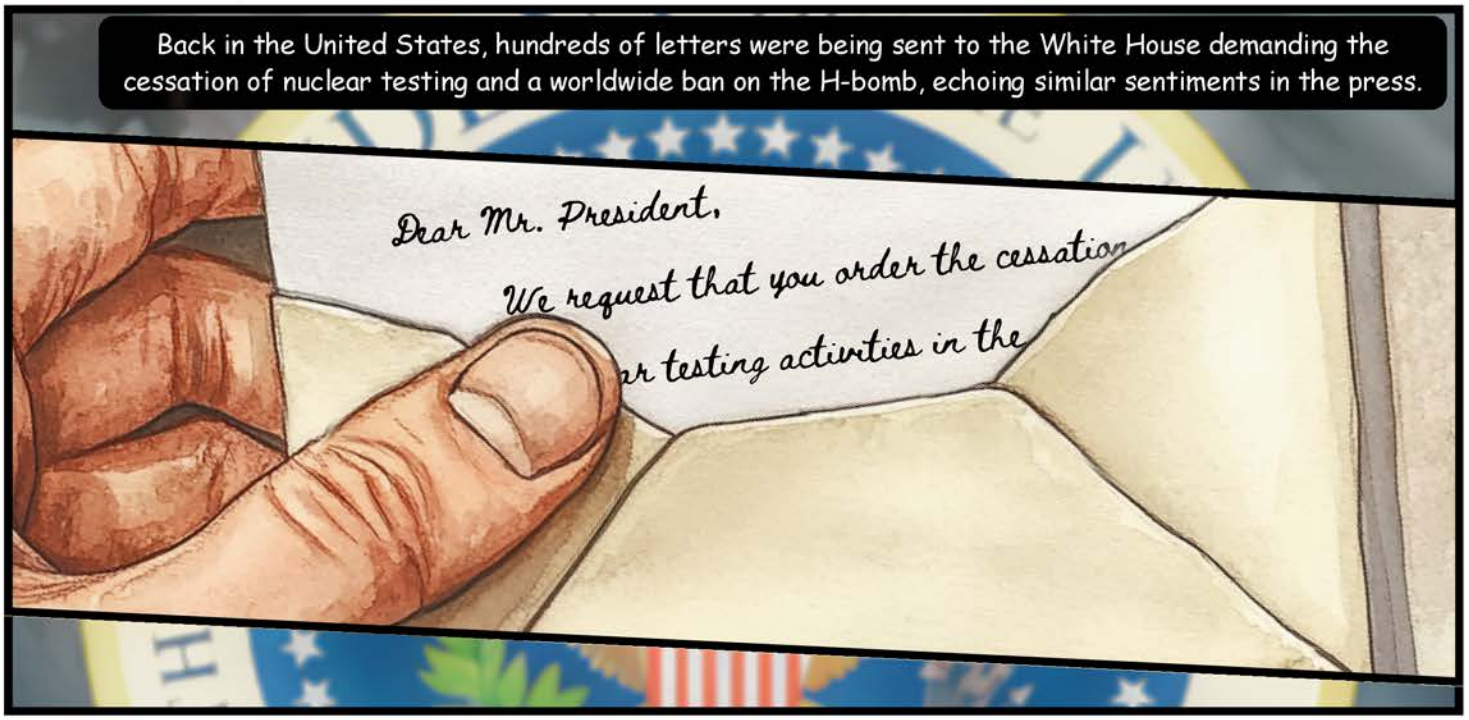
Diplomacy culminated in a $2 million settlement by the U.S. government, leaving victims bitter over a payment that was negotiated over their heads to preserve the U.S.-Japan alliance at the expense of human rights.

As protests spread, cities across Japan adopted resolutions against the use of atomic bombs.

Tens of millions of signatures against the testing of the hydrogen bomb were gathered in campaigns led by Japanese women.


原水爆禁止世界大会
WORLD CONFERENCE AGAINST ATOMIC & HYDROGEN BOMBS
In August 1955, the first "World Conference Against A- and H-bombs" was held in the city of Hiroshima.


The following year, atomic bombing survivors founded the Japan Confederation of A- and H-Bomb Sufferers Organizations - Nihon Hidankyo - in Nagasaki.
International Cultural Center, Nagasaki


Back in the United States, hundreds of letters were being sent to the White House demanding the cessation of nuclear testing and a worldwide ban on the H-bomb, echoing similar sentiments in the press.
Dear Mr. President,
We request that you order the cessation
testing activities in the

In an address to Parliament, Indian Prime Minister Jawaharlal Nehru called for a U.S.-Soviet "standstill agreement" to ban nuclear testing.

At the 1955 Bandung Conference, leaders of the emerging states in Asia and Africa called likewise for the suspension of nuclear tests.

A MAGAZINE FOR SCIENCE AN

Bulletin of the Atomic Scien

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L. W. Nordheim: Fear and Information
David R. Inglis: Why Ban H-Bomb Tests?

Civil Defense Faces New Pe

RALPH E. LAPP

Dr. Lapp assesses the radioactive hazard of "fall-out" and analyzes its impact upon civil defense. His data are gathered from Japanese sources, from independent calculations, and from the unclassified scientific literature. He urges that the federal government release classified data on fall-out to provide guidance to civil defense organizations.

N MARCH 1, 1954 chalk-white dust fell on twenty-three Japanese fishermen 72 miles from It took three hours for the pulcoral to start falling-out from nd coat the *Lucky Dragon* with a mantle of radioactive wever, it was not until late that the Federal Civil Denistration felt the impact

fficials in FCDA were nature of the fall-out. wn colored charts with ontours describing the y of the residual ra- superweapon explo- point FCDA had ht mostly in terms

opment. Indeed, a weapon twice its power was tested in the March-April CASTLE series of tests in the Pacific in 1954. Moreover, this weapon was a bomb, not a "device"—meaning that the United States now possesses a droppable bomb in the range of 20 megatons.

Faced with the prospect of corresponding weapons in the Soviet arsenal, Gov. Peterson recognized that too much of America's metropolitan population resided inside the 14 mile radius of the superbomb's punch. It was sheer suicide, he reasoned, to put 35 million Americans in the sitting-duck category. This is the simple background for the policy of evacuation which is now being implemented.

Meanwhile, scientists were speaking up about the harms of radioactive fallout...

Hydrogen-Uranium Bomb

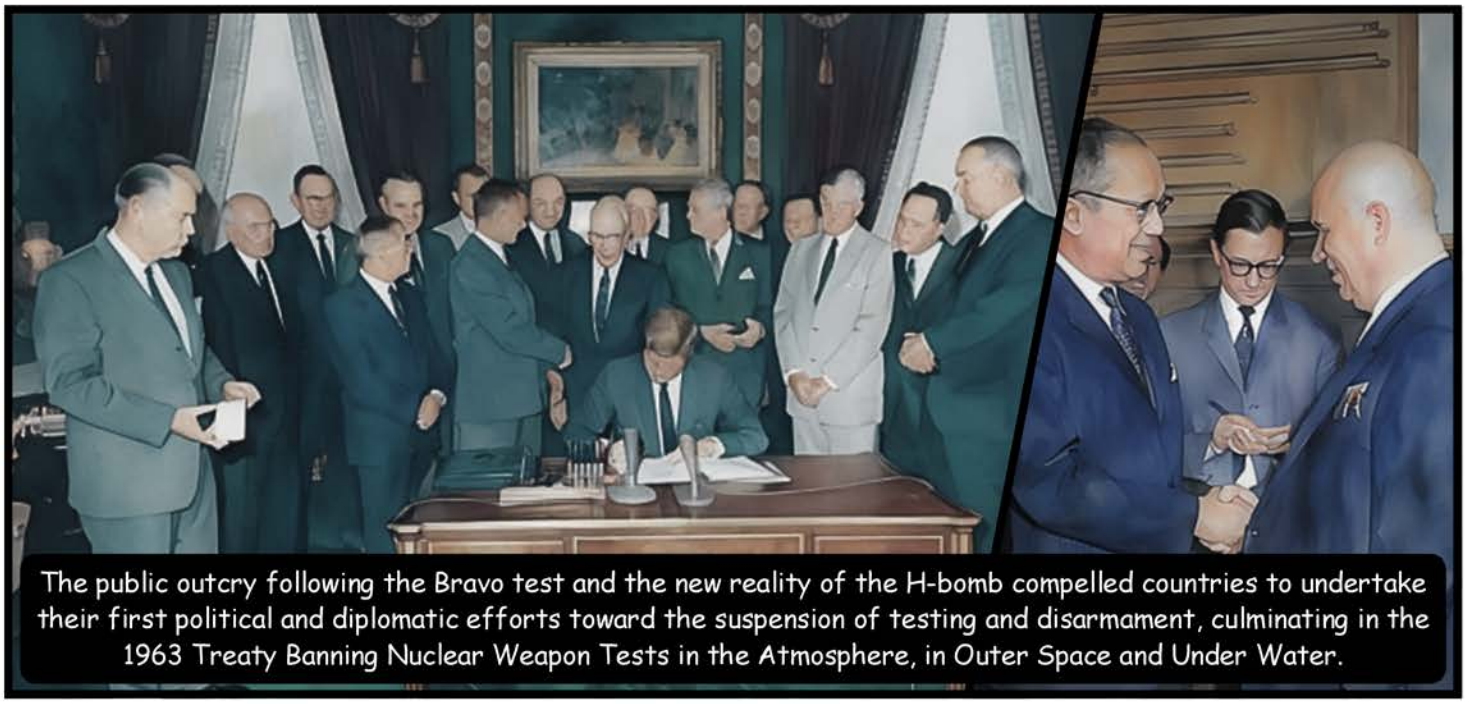
J. ROTBLAT

In the following article a British physicist speculates on the composition and possible radiological effects of the superbomb tested in the Pacific last spring. He concludes that it "is a kind of cobalt bomb; in some respects, it is even worse." Mr. Rotblat, executive vice-president of the British Atomic Scientists' Association, is professor in the Physics Department of the Medical

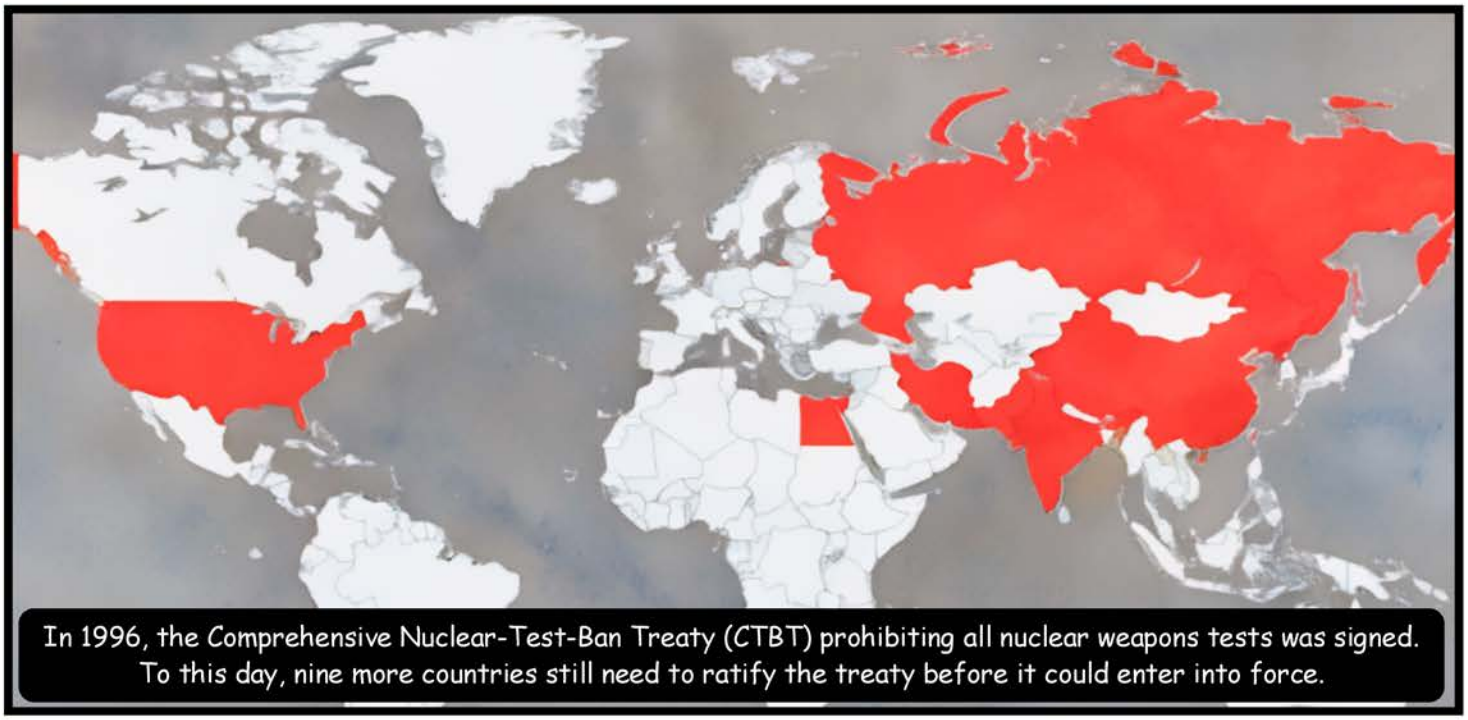
In 1955, former Manhattan Project physicist Joseph Rotblat revealed the multistage design of the thermonuclear bomb, explaining why the radioactivity of its fallout was so much higher than officially claimed.

A key figure in the Pugwash Conferences, Rotblat would go on to receive a Nobel Peace Prize in 1995.

In 2024, Nihon Hidankyo was awarded the Nobel Peace Prize for its decades of tireless efforts striving toward a nuclear-weapon-free world.



The public outcry following the Bravo test and the new reality of the H-bomb compelled countries to undertake their first political and diplomatic efforts toward the suspension of testing and disarmament, culminating in the 1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water.



In 1996, the Comprehensive Nuclear-Test-Ban Treaty (CTBT) prohibiting all nuclear weapons tests was signed. To this day, nine more countries still need to ratify the treaty before it could enter into force.

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