

Transcript: The city inside a glacier

Note: Episodes of Outside/In are made as pieces of audio, and some context and nuance may be lost on the page. Transcripts are generated using a combination of speech recognition software and human transcribers, and may contain errors.

Curt La Bombard: Okay, so I'm leaving our little trailer. We're kind of in our main staging area, which is pretty loud.

Nate Hegyi: On the edge of Denver, Colorado is a giant, flat, boring looking building... two to three times the size of your average Walmart.

Curt La Bombard: I'm entering our warm room - so it's kind of a 15X15 room, where we have some chairs...

But inside, it's actually a scientific storage facility, run by the National Science Foundation.

Curt La Bombard is its curator.

And even in the summer, when temperatures are in the 80's, Curt needs heavy winter gear to work here.

Curt La Bombard: [zips up jacket] There's actually a really fun piece of equipment in here to warm up our hands and eyeglasses.

That's because the collection he watches over is composed entirely out of ice.

Curt La Bombard: So I'm basically going to open a large freezer door, it's got a big hatch on it, so we'll do that... And it's about minus 26 centigrade, so it's not too bad compared to what I'm about to go into.

This is the National Science Foundation's Ice Core Facility. A giant freezer, where we keep some of our most precious – and vulnerable – scientific artifacts.

The ice cores stored here were dug from places like Antarctica and Greenland. Scientists use them to research the chemistry and the climate of Earth's ancient past.

Curt La Bombard: Alright, I'm going to go into back storage. So, I'm gonna hit the lights here.

In the back storage area, temperatures are kept a cool negative forty degrees.

Curt La Bombard: Back here is pretty cold. It's a bone soaking cold.

MUX FADE

The ice cores, cylinders of ice each a couple feet long, are collected in what look like long cardboard tubes lined with aluminum.

The way they're piled up makes it look like they go on forever. Each row is ten feet high, and over fifty feet long.

There's so many that, if you put all of the ice tubes here end to end, they would stretch for some fifteen miles.

Curt La Bombard: We have cores from Byrd station from 1968, we have cores from 1965...

And each of them... tells a story.

Curt La Bombard: and then we have the camp century core... I believe that's one of the oldest ones we have.

THEME

I'm Nate Hegyi, and this is Outside/In. Today on the show, producer Daniel Ackerman tells us the story of one of the oldest ice cores on record.

A tube of frozen water that helped unlock the planet's hidden climate history...

And the unlikely journey it took to get from the bottom of an arctic glacier to the back storage of a freezing cold warehouse in Denver, Colorado.

Curt La Bombard: It's not bad when you're working. When you're loitering, it gets pretty chilly.

It's a wild story - stay with us.

*THEME FADE**ARCHIVAL MUSIC IN*

Daniel Ackerman: Alright, let's start with the tape...

Army archive: On the top of the world, below the surface of a giant ice cap, a city is buried...

Daniel Ackerman: This isn't from James Bond or the Marvel Comic Universe. This is a documentary made in the 1960s by the US Department of Defense.

Army Archive: ... The United States Army has established an unprecedented nuclear-powered Arctic research center.

Daniel Ackerman: It's the height of the Cold War, and people in the US are panicked. My mom was in elementary school at the time. She and her classmates would practice hiding under their desks in case of nuclear war.

FCDA Clip: Please duck and cover! Duck and cover!

The Department of Defense thought that if the Soviets did lob a nuclear bomb at the US, it might come from the North. Over the Arctic. Over Greenland. So they turned the world's largest island into a giant geopolitical shield. A shield that included a military base carved below the surface of Greenland's massive Ice Sheet. They called it Camp Century.

Army archive: Camp Century is a symbol of man's unceasing struggle to conquer his environment, to increase his ability to live and fight if necessary under polar conditions

In some ways, Camp Century was a really impressive feat of engineering. The base itself was made up of about 2 miles of tunnels. The overlying snow and ice were held up by metal arches.

Army archive: Today, powered by its nuclear reactor, this unique installation is a completely modern community, deep under the ice. Here there are showers for all and facilities for every modern convenience.

Daniel Ackerman: There was a rec room, with a pool table. A little movie theater. A barber – cuts were 50 cents for enlisted men and a dollar for officers. By all accounts, the grub was decent.

Army archive: Everything from steak to fruit salad.

Daniel Ackerman: But when it comes to the actual purpose of Camp Century, as a military base to, quote, "conquer the environment and fight, if necessary, under polar conditions..." well, I'm gonna give away the ending now: Camp Century was a failure. A series of failures, really. I'll list just three of them.

[ENTER MUSIC]

Daniel Ackerman: Failure 1: The Army shot mortar grenades at clouds of fog. This was to try and disperse blizzard-like whiteout conditions. And it did not work.

Failure 2: The Army came up with a secret plan - called “Project Iceworm” - to turn Camp Century into the grand central station of a vast railroad network for under-the-ice nuclear launch sites. Then the Navy came up with a much cheaper approach: they could simply launch nukes from submarines.

And failure 3 is really the big one: The whole place collapsed in on itself. From the moment Camp Century was built, the ceilings began sagging toward the floors. The walls closed in. Because glaciers *move*. And you can't stop them. Less than a decade after it opened, Camp Century was abandoned forever.

But out of all of those failures, there's been one, HUGE, silver lining.

Julie Brigham-Grette: it's in those trenches that people realized... we could collect ice cores here and look at climate change.

[mux swell and fade]

Daniel Ackerman: This is Dr. Julie Brigham-Grette. She's a paleoclimatologist, which means she studies the history of Earth's climate, at the University of Massachusetts, Amherst.

And she says that, as of the mid-20th century, we didn't know a lot about climate change.

Scientists had proposed a century before that carbon dioxide in the atmosphere could lead to warming. But the idea wasn't mainstream because it was largely theoretical.

Julie Brigham-Grette: You know, I think we were terribly naive... we were really just getting an idea of how the temperature had changed... CO2 in the atmosphere was something we didn't really have any capacity to measure... We didn't have a way of even knowing about that.

Daniel Ackerman: But at Camp Century, the US military thought they could find out.

[MUSIC CUE]

Daniel Ackerman: For a couple of decades, scientists had been looking at ice cores as a kind of archive of climate history. And when I say ice cores, I mean long, skinny cylinders of ice pulled out of a glacier. And that's because, when snow falls on a glacier, it doesn't just melt the following spring. It stays there. The next year, even more snow falls on top of it.

Julie Brigham-Grette: And it starts to pile up...

Daniel Ackerman: The deeper you go, you'll find denser and denser layers of snow. And trapped between the snow crystals are little bubbles of air.

Julie Brigham-Grette: As the snow compresses, it literally compresses the bubble. And so the fossil air is preserved in this perfect little chamber in there.

Daniel Ackerman: This happens year after year, for millennia. So when scientists look at an ice core...

Julie Brigham-Grette: You can see just annual layers, much like many of us might look at a tree that's been chopped down and you see the rings in ice going back tens of thousands of years.

MUSIC SWELL

Daniel Ackerman: And you can take samples of those annual layers to see how much carbon dioxide was locked into those air bubbles from ten thousand years ago. Or from 100,000 years ago. And you can estimate the temperature from those periods too, by measuring the weight of oxygen isotopes in the ice.

And together, these analyses could give an amazingly detailed history of how carbon dioxide and temperature have varied throughout history, since long before humans were shaping the climate.

MUSIC SWELL AND FADE

Daniel Ackerman: We know how important studying climate change is now. But back in the '60s, it was more of a curiosity.

Julie Brigham-Grette: Why not? Let's take an ice core here and... see what comes out of it...

The Navy wanted to know how quickly sea ice conditions could change in the Arctic Ocean. A core might also answer some basic scientific mysteries. Was the Greenland ice sheet as old as the Egyptian pyramids? As old as the dinosaurs?

Julie Brigham-Grette: They wanted to get all the way to the base, just to see what they would find.

Daniel Ackerman: The problem was, nobody had ever collected an ice core this size before. At its thickest point, the Greenland ice sheet is almost two miles deep. What kind of machine could even extract such a long core? And how could you make sure the ice didn't melt or shatter along the way? The technology to do this simply didn't exist.

That's where Herbert Ueda Sr. comes in.

Herb Ueda Jr: So it's kind of ironic. My dad was named after what today is viewed as somewhat of a failed president, but anyway...

This is Herbert's son, by the way, Herb Jr. Herb Sr. died in 2020¹.

MUSIC IN

Herb Ueda Jr: And he was named Herbert, after Herbert Hoover. This is, you know, this was six months before the stock market collapsed and the country fell apart.

Daniel Ackerman: Herbert Ueda Sr. is the man responsible for collecting one of climate science's most important artifacts.

He helped lead the mission to extract the Camp Century ice core – which, if you know Herb's back story – is kind of surprising.

Herb Sr. was born in 1929, to parents who immigrated from Japan and worked on a farm in Washington State.

Herb Ueda Sr: And, uh, we were of Japanese descent, uh –

Daniel Ackerman: This is the voice of Herb Sr. himself, from an interview he gave in 2002.

Herb Ueda Sr.: So, uh, well, things got a little disrupted on December the seventh, 1941.

FDR speech: A date that will live in infamy...

¹ <https://www.stringerfh.com/obituary/herbert-ueda>

When Japan bombed Pearl Harbor, the US government forced more than 100,000 Japanese Americans into internment camps, based on unfounded suspicion they may be sympathetic to Japan's war effort.

Herb Sr. was 13 when his family was sent to Minidoka War Relocation Center in Southern Idaho².

The place was designed and built by the US Army Corps of Engineers. Families lived in barracks, surrounded by barbed wire fences. For years.

Herb Ueda Sr.: You know, we, we had firemen, policemen, so to speak, uh, schools, uh, you know, churches, uh, a couple little stores. Course, you couldn't just walk outta camp either...if you want to go on a little excursion somewhere, you just crawl over the fence or under the fence or whatever it was, and go out and join the jackrabbits and rattlesnakes.

Daniel Ackerman: Herb Sr. spent three years of high school incarcerated among the jackrabbits and rattlesnakes.

Later in life, he almost never spoke about his time there. But Herb Jr. said it changed him.

Herb Ueda Jr.: he did not completely buy into America first and America is the greatest place in the world. He didn't preach any of that stuff because he knew there was, there was shortcomings and in his experience, things where it failed him, you know...

In 1988, nearly 50 years after the internment, the government finally agreed to pay reparations.

Herb Ueda Jr: They gave every internee \$20,000. And Dad took the check and kinda, he just kinda chuckled about it. He didn't say it, but you could tell

² Ueda Sr. oral history (bottom p.1):
<https://kb.osu.edu/bitstream/handle/1811/44677/Uedatranscript1.pdf?sequence=1&isAllowed=y>

that the thought was like... too little, too late, guys. But he was a patriotic American. He went into the service right after.

Daniel Ackerman: After the war, Herb Sr. went to college and earned a degree in mechanical engineering. Then, he took a job with the US Army Corps of Engineers – the same branch of the military that built the internment camps where he was forced to live.

And this might seem like a feat of cognitive dissonance. But as Herb Jr. explains, his father navigated this by keeping his mind on his work – the math, mechanics, and machinery – and not the context surrounding it.

Herb Ueda Jr: He was wholeheartedly... into what he did... normal things like you and I would engage in – social things, hobbies, you know, fun stuff – uh, not a lot of that in his life...

MUSIC IN

His mind was, was churning over what was the next physical problem to solve at work.

Daniel Ackerman: And his assignment from the Army Corps was just about the biggest “physical problem” Herb Sr. had ever encountered at work.

Herb Ueda Jr: He was singularly focused on, on pulling up this damn ice core.

MUSIC OUT

Daniel Ackerman: So Herb Sr. went to Greenland to try and drill through the ice sheet, all the way down to the bedrock. Why? Well, the “why” wasn’t the point. It was an experiment.

But merely getting to Camp Century was a challenge that could freeze your pants off. The closest human settlement is across 150 miles of windswept ice.

The US doesn't own Greenland, by the way, though it has tried multiple times to buy it.

MUSIC SNEAKS IN

Greenland was, and is, part of the Kingdom of Denmark.

So the Army Corp had to get Denmark's permission to build Camp Century and other nearby bases. They didn't bother seeking permission from the 30 thousand residents of Greenland itself³.

MUSIC SWELL

Daniel Ackerman: Do you remember when you first got there, was there someone who told you what your mission was gonna be?

Don Garfield: I was there to do whatever I was told to do.

Don Garfield was a drilling engineer who worked for Herb Sr.

He says the first time his team tried to travel to Camp Century, they got waylaid by a blizzard. A bad one.

Don Garfield: they classified the storms... they called them phases, Phase 1, which was not bad. Phase 2 and Phase 3. Well, we were in a Phase 3.

³ Population as of late 1950 when bases were built. Page 120 of pdf:
<https://unstats.un.org/unsd/demographic-social/products/dyb/dybsets/1978%20DYB%20Special%20Issue.pdf>

Daniel Ackerman: Phase 3 meant zero visibility and hurricane-force wind. Gusts could top 200 mph, hurling baseball-sized chunks of rock⁴.

Don said the drilling team had to hole up in army barracks on the edge of the Ice sheet, eating nothing but canned rations for an entire week.

MUSIC OUT

Don Garfield: The wind was blowing so bad. It was coming in the windows, around the windows and doors. We had to use our underwear and socks and towels to keep the snow from blowing in. But anyway.

Daniel Ackerman: The storm eventually cleared. Don recovered his frozen underwear, and finally hopped a flight to Camp Century. They were headed into a camp that was slowly collapsing in on itself. And it smelled like human waste. Sewage was poured into an unventilated hole in the ice, not far from the living quarters.

On the plus side, there was steak and fruit salad.

Clip: The modern spacious kitchens provide a well-balanced and appetizing menu.

To Herb Ueda, though, none of these practicalities mattered. He had a mechanical problem to solve. He had to pull up a 6-inch wide, mile-long core of ice, which had never been done before.

MUSIC IN

Daniel Ackerman: Ok, so let's talk machinery. The Army Corps had invented a special drill for the job. This drill didn't have a sharp, spinning cutting bit on the end, like your drill at home might. This was a thermal drill, designed to melt its way down into the ice. The leading edge was a heated metal ring

⁴ <https://www.557weatherwing.af.mil/News/Features/Display/Article/872212/two-of-thules-extreme-storms/>

that seared a circle down into the ice, and carving out a cylinder that the team could pull up in segments of a few feet each.

It was a pretty cool idea. Until they tried using it. Don Garfield says it drilled at a pace of about an inch of ice per minute.

Don Garfield: If everything worked, it would've taken a long, long time to drill through thousands of feet of ice.

Daniel Ackerman: And did it work okay though, even if it was slow?

Don Garfield: No, it never worked okay [laughs].

Daniel Ackerman: Each time they thought they'd pulled up a nice cylinder of ice, it would splinter.

Don Garfield: The ice would come up in wafers and, and so it'd end up all in pieces. Well, the scientists didn't like that.

Daniel Ackerman: High-ranking military officials would sometimes stop by the drilling rig. Not to offer help, but to collect those ice splinters.

Don Garfield: The big wigs in camp liked to get pieces of the ice core to put in their drinks... it would snap. The bubbles would pop because they're under high pressure.

Even worse for Don and Herb, the work was hazardous. As they drilled into the ice, they had to keep the hole from re-freezing and closing up. They did that by filling the hole with fluid that was the same density as the surrounding ice. They used a mix of diesel and a chemical called trichloroethylene.

Don Garfield: When we would bring the drill up to recover the core, uh, of course it was covered in this fluid and it would splash on us... Our clothes were soaked in diesel fuel and trichloroethylene.

Daniel Ackerman: The situation made the drillers a team of outcasts in the under-ice camp. At the end of the day, everyone else might unwind over a couple of beers. Not the drillers.

MUSIC IN

Don Garfield: We couldn't drink. Trichloroethylene and alcohol did not mix well. We would get all flushed and red. So we just, we had no desire to drink.

Daniel Ackerman: Were you scared for your health?

Don Garfield: Back then they said that was not carcinogenic, but, now they're saying it's highly carcinogenic.

Daniel Ackerman: Don's battled stage 4 lymphoma and bladder cancer. He attributes them to his years working with trichloroethylene.

MUSIC SWELL AND FADE

Which, by the way, was not only bad for the people. It caused parts of the drill to rust. Sometimes, to seize entirely.

In the summer of 1959, the first year the team used the thermal drill in Greenland, they barely got any ice at all.

Here's Herb Ueda Sr. again.

Herb Ueda Sr: We drilled a total of 89 inches that year, and, uh, that was about as far as we got. Mm-hmm.

Daniel Ackerman: 89 inches. There are NBA players taller than that.

Herb Ueda Sr: It was pretty disappointing. Just didn't work.

MUSIC IN

The project was seasonal. Every summer, the team made a little more progress. In 1961, they made it 575 feet before the drill got stuck in the hole. The year after, it was 750 feet before the drill got stuck again. They hadn't even gotten a quarter of the way through the ice sheet.

Herb Ueda Sr: It was just a struggle. Mm-hmm. Just a struggle.

Daniel Ackerman: By the summer of 1964, Don says The National Science Foundation — which funded the drilling — started pressuring the team to throw in the towel. Enough time and money had been dumped down that narrow hole in the ice.

But Don Garfield says that to Herb Ueda, money and time weren't a problem.

Don Garfield: That was one thing with Herb. He never gave up... a normal person would've given up a long time before that [laughs].

Daniel Ackerman: By some accounts, Herb stayed under the ice, working in the drilling trench for months at a time – breaking only for food and sleep – never once coming up to the surface to see the sun. But he just could not get the thermal drill to work.

Herb Ueda Sr.: And finally I said, you know, we got to start considering something else.

MUSIC SWELL

Nate Hegyi: That “something else” would bring Herb away from Greenland that fall. Back to the US. To, of all places, the oil fields of Oklahoma. That’s right after the break.

MUSIC FADE

BREAK

Daniel Ackerman: This is Outside/In. I’m producer Daniel Ackerman.

Before we go back to Greenland: a quick detour to the American South. Because at the same time that humans were first unlocking the secret history of Earth’s changing climate, we were also ramping up extraction of the fossil fuels that have sped it up.

Through the middle years of the 1900s, the oil industry was booming. Geologists were flocking to the business, to try and locate new oil reserves. And engineers were inventing new ways to recover them.

One of those engineers was a Russian immigrant named Armais Arutunoff. His key innovation was an electrical pump that could be submerged in fluid. That allowed companies to drill for oil in all kinds of new terrain. Groundwater in the hole? No problem.

Arutunoff started a company around his new drilling technology. And, seemingly on little more than a whim, Herb Ueda took a trip down to Oklahoma to check it out.

And the story goes that they found one of Arutunoff’s drills sitting unused in a cornfield. Here’s Herb Ueda Sr. from 2002.

Herb Ueda Sr.: And he was willing to get rid of it for 10,000 bucks or something, you know, a bargain.

Daniel Ackerman: It was a deal. Ueda bought the drill. His team designed a diamond-encrusted cutting bit to attach to the pump, to allow it to slice through glacier ice. They hauled the contraption up to Camp Century the next summer, in 1965.

And this new drill was really their last chance to save the project. Because Camp Century was on its last legs. The Greenland Ice Sheet was doing its best to crush the base like a soda can. And by now, the Army had assigned up to 50 men just to go around the Camp with shovels and chainsaws and try to keep the walkways passable. So, it was now or never: the new drill had to work.

They fired it up. Moment of truth...

Herb Ueda Sr.: Lo and behold...it worked like a charm.

MUSIC SWELL

Daniel Ackerman: Suddenly, Herb's crew was slicing through 100 feet of ice per day. 5 or 6 times faster than the thermal drill. And the cores they pulled up were solid. They didn't disintegrate into cocktail adornments for the army officers. The frustration and heartbreak of the thermal drill gave way to a new rhythm.

The team would pull up a segment of the ice core, usually 3-10 ft long, and hand it off to Chester Langway, the scientist in charge of analyzing the ice.

Langway would shuttle it off to his collection facility. He'd inspect the length of the core – measuring it, looking for layers of grit that might signal ash from ancient volcanic eruptions.

And when he was done, he'd slide the core into a cardboard tube, carefully label it, and store it in a rack on the wall. And as the number of core segments grew into dozens, then hundreds, Langway's collection room began looking like the world's coldest wine cellar.

MUSIC OUT

It was all going great. Until...

Don Garfield: We were down about, oh, 3,300 feet, I think it was.

Daniel Ackerman: After slicing another cylinder of ice, Don pulled the drill up to the surface, to recover the core, as he'd done hundreds of times before. But this time.

Don Garfield: The bottom part of the drill wasn't there... and for some reason the connection between the drill motor and the gear reducer section of the drill came unscrewed. And so the whole bottom part of the drill was left down the hole.

Daniel Ackerman: Wow. Wait, so there was a cable going all the way down attached to the motor, but then the lower part had fallen off?

Don Garfield: Exactly.

Daniel Ackerman: Uh oh.

Don Garfield: Our initial reaction was, we're finished, we're all done.

MUSIC SWELL

Daniel Ackerman: They were closer than they'd ever been before. But the drill Herb had hauled all the way from a cornfield in Oklahoma – the drill that seemed like maybe it could salvage this whole endeavor – was stuck more than half a mile into the Greenland Ice Sheet.

Don had one last-ditch idea to recover the drill. He went ice fishing.

Don Garfield: I came up with the idea of using leaf springs... it would be like a hook on the end of a flat strip of metal.

Daniel Ackerman: Leaf springs are normally used in the suspension system of vehicles. But Don found some lying around camp, and he essentially turned them into three fishing hooks, attached to a slowly spinning motor.

Don Garfield: And so I very slowly lowered that down.

Daniel Ackerman: He was hoping at least one of the hooks would snag part of the drill stuck thousands of feet below.

Daniel Ackerman: What was going through your mind as you were lowering this thing down?

Don Garfield: Oh, I, I just figured we would never be able to get this thing.

Don Garfield: Very carefully I raised it up.

MUSIC OUT

Don Garfield: We got to the surface very slowly, very carefully. We got up there and, and two of the springs had hooked on the lower section... It grabbed it...

MUSIC IN

Don Garfield: to me, that was probably the highlight of the... whole drilling exercise... I mean... that was more, uh, satisfying than, than drilling to the bottom [laughs] ...we saved the whole drilling program, you know.

Here's Herb Ueda Sr. from 2002.

Herb Ueda Sr: And finally, in 1966, uh, uh, on July the fourth... we finished the job at 4,150 feet.

Interviewer: Yup, and did you hit bedrock?

Herb Ueda Sr.: Yeah, we hit bedrock. Finished job.

Interviewer: So it took that long... You were the head driller.

Herb Ueda Sr.: Well, no, I worked for Lyle...

Interviewer: I think you're being humble.

Herb Ueda Sr.: Probably the most satisfying moment of my life – of my career. Of my career, of my career.

Herb Ueda Jr: Uh, thanks. That was awesome.

Daniel Ackerman: Herb Jr. knows a lot about his Dad's work. But he had never heard this tape before. So I played it for him.

Herb Ueda Jr.: Did you notice a couple things there?

A), the, uh, the humility, cuz all, all these guys will tell you, he was the guy, but I gotta laugh. He says, the most satisfying thing in my life. And then he is thinking, oh damn, my wife and kids are gonna hear this. Right? You know, I gotta make a correction. Who are we kidding? His career was his life. It was his life. And, and that's okay. You know, but you could hear him, oh, damn Pat's going to hear this. Uh, not the birth of his kids. Not, and that's, that's who he was. You know, I, I, that's great. He could be that honest.

Daniel Ackerman: After six years of trial and error, Herb Ueda Sr. had solved the mechanical problem before him. Don says the team celebrated their achievement – with a cup of coffee. Alcohol wasn't an option because of the chemical fumes. The engineers packed up the drill rig. The scientists carefully packaged up the hard-won loot.

Julie Brigham-Grette: These ice cores... really blew open the whole story of climate change... This was revolutionary.

Daniel Ackerman: This again is climate scientist Dr. Julie Brigham-Grette. It took a few years for scientists to analyze all those annual layers and ancient air bubbles. In 1969, they published a paper in the journal *Science*. It was called, “One thousand centuries of climatic record from Camp Century on the Greenland Ice Sheet.”

Julie Brigham-Grette: That Camp Century Ice Core really opened the door to thinking about past climate change with the fidelity of time that nobody had ever seen before.

Daniel Ackerman: The paper showed that dramatic changes in the climate could happen over relatively short periods of time. Sometimes just a few decades. And the Camp Century core provided nearly a mile of hard evidence that increasing levels of carbon dioxide in the atmosphere means warmer temperatures. It helped confirm a century of theories about the greenhouse effect, and how burning fossil fuels can turbocharge it.

And it helped spawn a whole new scientific field – paleoclimatology – where scientists study the deep history of our planet using the traces left behind. Ancient trees and caves. The sediment of lakes and oceans. And, of course, ice.

Julie Brigham-Grette: The idea that you could have an archive that would preserve, um, essentially fossil air in little bubbles and, which then drove us... well, what if we drilled the oceans? What if we drilled other ice sheets? What if we went to Antarctica?

Daniel Ackerman: That’s actually what Herb Ueda did. After mastering the ice drilling technique in Greenland, he brought the contraption down to Antarctica, where he pulled up a core almost a mile and a half long.

And as for Camp Century? The army abandoned the collapsing camp pretty much as soon as the drilling team finished the job.

The Camp Century ice core – and the astonishing insight it's provided – is perhaps the one useful legacy of the city under the ice.

And it's a reminder that science is a messy endeavor. Some of society's biggest scientific achievements were driven by our worst impulses. Advanced weather forecasting, computing, space exploration – these are all to some degree byproducts of otherwise devastating conflicts.

Camp Century itself was built in part to fight a nuclear war. And that led to another legacy, beyond climate science. A darker legacy.

The US forcibly relocated dozens of Greenlandic families to make way for the Thule Air Force Base, which supported Camp Century. The residents were given just three weeks' notice.

And scientists say radioactive waste from the Camp's defunct nuclear reactor – waste that was never fully removed – could impact coastal communities by the end of this century, as the ice sheet moves and melts.

Aleqa Hammond: I think that this is the biggest environmental disaster that Greenland ever has encountered in the Arctic.

Aleqa Hammond is the former Prime Minister of Greenland. She's one of many politicians and activists who have called on the US to fund a cleanup of Camp Century.

Aleqa Hammond: United States have opened their consulate here a couple of years ago, wanting to build bridges between United States and Greenland and be in friendship. And I think that is a very good idea, but why don't they clean up their mess before they take the next step? ... This is 2023 and this Camp Century should be history and cleaned up by now.

Denmark has pledged some money to clean up some Cold War-era military waste in Greenland, but not Camp Century specifically. And the US has made no commitments at all.

Aleqa Hammond: They don't give a shit about it.

Today, somewhere under the western Greenland Ice Sheet is a jumble of beds and mattresses, sinks and refrigerators, toilets and mountains of human waste. A pool table. A barber's chair. All of it flowing inevitably toward the ocean.

MUX SWELL AND FADE

MUSIC IN: *"Bert the Turtle Duck and Cover song"*

Nate Hegyi: A quick update to this story: Don Garfield – he was the engineer that used a makeshift fishing hook to rescue the drill – was interviewed for this story last year.

But just after we wrapped up production, we discovered that Don died of cancer this past February.

He was 81.

Thanks to Daniel Ackerman for reporting this story.

And if you want to see pictures from Camp Century, or get a peek at the NSF Ice Core Facility where parts of the Camp Century core are stored today, sign up for our (free) newsletter, or check out the links in the show notes.

This episode was produced by Daniel Ackerman.

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Editing help from me, Nate Hegyi, Justine Paradis, and Felix Poon.

Rebecca Lavoie is *Outside/In*'s executive producer.

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MUSIC SWELL AND FADE