Episode Book

EPISODE #5651

Nuclear Convoys: The Physics Package and the Highway

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SYNOPSIS

Nuclear warheads have to be maintained, and maintenance means movement. The Office of Secure Transportation runs 42 tractor-trailers and roughly 700 federal couriers, logging about three million miles a year moving warheads, components, and special nuclear material across the United States. This episode digs into what a warhead's physics package actually looks like — and why the modern ones have never been shown publicly — before walking through why the US keeps roughly 3,700 warheads, how Life Extension Programs force cross-country trips like the W76-1's journey from Bangor, Washington to the Pantex Plant in Texas, and what happens when a Safeguards Transporter shares the road with ordinary drivers.

TRANSCRIPT



Corn

Here's a question I assumed was obscure. Daniel asked what nuclear warheads actually look like. Specifically, how big the physics package is relative to the weapon itself. He figured that was a deep rabbit hole with no public answer.



Herman

And?



Corn

And it turns out the answer is everywhere. He went to YouTube expecting nothing and found exactly that, plus a whole genre of footage he didn't know existed. Nuclear missiles being moved in convoys. Not one country, either. He found videos from across the world.



Herman

The convoys are the part that gets people.



Corn

They got him. He noticed the US keeps a standing stockpile that isn't small, distributed across bases as part of what he called a doctrine of distributed deterrence. But the detail that stuck with him is that warheads have to be periodically maintained. Which means they get moved. By road. On civilian highways.



Herman

With air support.



Corn

With air support flanking the convoy at all times, and a truck he described as virtually indestructible. So you have this remarkable logistical operation happening often enough that there are elaborate protocols around it, and meanwhile ordinary people are going



Corn (continued)

about their day as a nuclear warhead crosses the road in front of them. Daniel wants to talk about this intriguing form of convoy.



Herman

So do I.



Corn

Then let's start with the paradox, because it's the whole episode in one line. These are the most secretive objects on Earth, and their transport is visible enough that people photograph the trucks and post them to Reddit asking what is this thing.



Herman

That's genuine. There's a subreddit that exists basically for people to identify things they saw, and nuclear convoy vehicles show up there. Dark box trucks with government plates. Somebody sees one at a truck stop, takes a picture, and the internet tells them what they were standing next to.



Corn

Which means the secrecy is thinner than the phrase most secretive objects on Earth would suggest.



Herman

It's thinner in a specific way. The objects are secret. The logistics are not, or not entirely. There's a division of the Department of Energy, under the National Nuclear Security Administration, called the Office of Secure Transportation. OST. It was established in 1975, it's headquartered in Albuquerque, and it trains its people at Fort Chaffee in Arkansas.



Corn

What does it actually move?



Herman

Nuclear weapons, weapon components, and special nuclear material. Not just finished warheads. Parts, pits, material. Anything in that family that has to get from one secure facility to another.



Corn

And the scale?



Herman

Forty-two tractor-trailers. Around seven hundred federal agents, who are called couriers. An annual budget somewhere in the range of two hundred forty to two hundred fifty million dollars. And they log about three million miles a year.



Corn

Three million miles a year moving nuclear material.



Herman

The fleet has accumulated over a hundred million miles of over-the-road experience. That number is the one that matters, and we'll come back to why.



Corn

So here's the arc I want to run. First, what a warhead actually looks like, because Daniel's original question has a real answer and it's stranger than he expected. Second, why the US keeps roughly thirty-seven hundred warheads and why they have to move at all. Third, how the convoys work, and what happens when one shares the road with you.



Herman

Good.



Corn

Define it.



Herman

The explosive part of a nuclear weapon, the part where the fission and fusion actually happen, has its own name in the technical literature. The physics package. Alex Wellerstein, who runs the Restricted Data blog, points out that it's an amusingly euphemistic name. Physics package sounds like something that arrives in a padded box.



Corn

It's a bomb with a gift-wrap name.



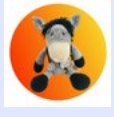
Herman

And the boundary between the physics package and the rest of the weapon is a little arbitrary. That's Wellerstein's phrasing. Fuzes aren't part of it. Fins aren't part of it. The physics package is the core, and everything around it is delivery and safety and arming.



Corn

So when Daniel asks how big the physics package is relative to the weapon, the honest answer is that the weapon is mostly not the physics package.



Herman

Right. Take the W88. That's a warhead that yields up to four hundred seventy-five kilotons. The reentry vehicle, the part that comes back through the atmosphere, is about sixty inches long with an eighteen-inch base diameter. The physics package inside it is roughly thirty-five inches long.



Corn

So the physics package is a bit over half the length of the thing you'd see.



Herman

And the reentry vehicle is already the small end of the weapon. The W80 is a different case. Two hundred ninety pounds, thirty-one point four inches long, eleven point eight inches in diameter. That's a warhead you could conceivably put in the trunk of a large car, if the trunk were rated for it, which it is not.



Corn

The W87?



Herman

Warhead four hundred forty to six hundred pounds, sixty-eight point nine inches long, twenty-one point eight inch base diameter on the reentry vehicle. Three hundred kilotons, upgradable to four hundred seventy-five.



Corn

So the numbers range. But the pattern holds. The physics package is smaller than the casing, and the casing is smaller than people picture.



Herman

Here's where it gets interesting, though. Wellerstein notes that the physics packages of the W76, the W87, and the W88 have never been publicly shown. What you see in photographs are the reentry vehicles. He calls them the dunce caps of the nuclear age.



Corn

The cone.



Herman

That's the shape everyone recognizes. The actual physics package inside it, for the current generation, is not public.



Corn

So Daniel's question is answerable for old weapons and not for current ones.



Herman

Which is itself the answer. Weapon shapes were secret from the beginning. The casings of Little Boy and Fat Man weren't declassified until 1960. Fifteen years after the war ended, and the shapes were still classified.



Corn

Why would the shape of a bomb be a secret? Everybody knew roughly what it looked like from photographs of the aftermath.



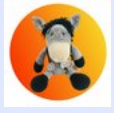
Herman

Because shape tells you about design. Wellerstein quotes Ted Taylor, who worked on weapons, on seeing a particular bomb casing. Just looking at it, Taylor said, tells you a great deal about the design of an H-bomb.



Corn

So the silhouette is the secret.



Herman

The silhouette is the secret. Which is why the modern physics packages stay off camera and the cones show up on Wikipedia.



Corn

All right. Numbers. How many does the US actually have?



Herman

The Bulletin of the Atomic Scientists puts the stockpile at roughly thirty-seven hundred warheads as of February this year. That breaks down to about seventeen hundred seventy deployed, and about nineteen hundred thirty in reserve, held back as what's called the hedge. Then there are another thirteen hundred forty-two or so that are retired and awaiting dismantlement. Total inventory, if you count the retired ones, comes to about five thousand forty-two.



Corn

And deployed means what, precisely?



Herman

Four hundred on intercontinental ballistic missiles. About nine hundred seventy on submarine-launched ballistic missiles. Three hundred at US bomber bases. And about a hundred tactical bombs in Europe.



Corn

The last number is the one people don't expect.



Herman

A hundred tactical bombs sitting in Europe is a fact that surprises almost everyone who hasn't looked. They're part of the NATO arrangement, and they've been there for decades.



Corn

What's the official disclosure number?



Herman

The US government disclosed three thousand seven hundred forty-eight warheads as of September 2023. That was an eighty-eight percent reduction from the peak. The peak was thirty-one thousand two hundred fifty-five warheads in 1967.



Corn

Thirty-one thousand.



Herman

In 1967. And the global picture, from SIPRI in January, is about twelve thousand one hundred eighty-seven warheads across nine states. The US and Russia together hold roughly eighty-six percent of that.



Corn

So the US is a bit under a third of the world total, Russia is a bit over half, and the other seven states split the remainder.



Herman

That's the shape of it.



Corn

Now the maintenance question. Why do these things have to move?



Herman

Because they have finite design lives. A warhead is not a rock. It has components that age. Plutonium pits, tritium reservoirs, electronics, the conventional high explosive that surrounds the pit. All of it degrades on a schedule.



Corn

Tritium in particular.



Herman

Tritium has a half-life of about twelve and a half years. You can't store it indefinitely. It has to be replenished, and that means the warhead has to go somewhere it can be worked on.



Corn

So the warhead leaves the base.



Herman

It leaves the base. And the mechanism for extending a warhead's life is called a Life Extension Program. An LEP. The idea is to take an existing warhead, refresh the aging components, and get another twenty to thirty years out of it without building a new design.



Corn

Give me a concrete one.



Herman

The W76-1 LEP. The W76 is a submarine-launched warhead. The original design life was about twenty years. The LEP extended it to sixty. NNSA completed W76-1 production at the Pantex Plant in December 2018.



Corn

Pantex being where?



Herman

Near Amarillo, Texas. It's the nation's primary facility for final assembly, dismantlement, and maintenance of nuclear weapons. If a warhead needs work, Pantex is where the work happens.



Corn

So the W76 warheads had to get from wherever they were to Amarillo.



Herman

Roughly a thousand of them traveled from Bangor, Washington back to Amarillo for the upgrade.



Corn

Bangor, Washington is a submarine base.



Herman

It's a Trident submarine base. So you had about a thousand warheads making the trip from the Pacific Northwest to the Texas panhandle, over a period of years, by road.



Corn

That's the convoy Daniel saw.



Herman

That's the convoy. And that's why the convoys exist. Not because anyone wants to move nuclear weapons around, but because the alternative is letting them sit until they don't work.



Corn

Let me push on the term Daniel used. Distributed deterrence. He described the US stockpile as distributed across bases as part of a doctrine of distributed deterrence.



Herman

I looked for that as a formal doctrine and I couldn't confirm it. It's not a named US policy as far as I can find. What's real is two adjacent things.



Corn

Go.



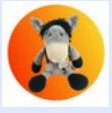
Herman

The first is the hedge. That nineteen hundred thirty warheads held in reserve. They're not deployed, they're not assigned to a delivery system, but they exist and they're maintained. That's a distributed reserve in a practical sense.



Corn

And the second?



Herman

The 2023 bipartisan Strategic Posture Commission recommended that the US consider road-mobile ICBMs and dispersed basing. That's the closest thing to a formal distributed posture, and it's a recommendation, not a policy.



Corn

So distributed deterrence is a descriptive phrase, not an official term.



Herman

Descriptive. The underlying idea is real. The label isn't.



Corn

Which matters, because if you go looking for the doctrine by that name you won't find it, and you'll assume you're missing something.



Herman

You'll assume it's classified. It isn't. It just isn't called that.



Corn

Now. The trucks. Daniel called the transport truck virtually indestructible. Is that right?



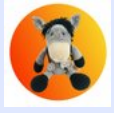
Herman

It's close to right, with a caveat. The vehicle is called the Safeguards Transporter. SGT. It's a modified Peterbilt eighteen-wheeler towing a custom trailer called a Safe Secure Trailer. Sandia National Laboratories designed it. The current generation was built around the year 2000.



Corn

What's in the trailer?



Herman

The warhead, in a cradle, inside a structure that is heavily armored. The trailer doors are over twelve inches thick. There are firing ports. Run-flat tires. Automatic sanders that lay down grit on slick roads. And the sleeper cab has been converted to two extra seats for armed crew.



Corn

So the crew rides in the tractor, and there are extra armed people in the sleeper.



Herman

Plus the escort. Three dark Chevrolet Suburbans, four armed crew in each. That's twelve more people. And then air support.



Corn

Heavily armed, per Daniel.



Herman

Heavily armed aerial support is the phrase that shows up in the documentation. The exact role of the aircraft is not publicly documented. What is documented is that OST operates three Boeing 737s registered to the NNSA, plus smaller aircraft, out of a hangar at Albuquerque Sunport.



Corn

And the 737s are for escort?



Herman

NNSA says they're primarily for logistical support and personnel transport. The documents don't rule out weapons transport, but the escort role isn't spelled out.



Corn

So the air support Daniel saw in the videos is real, and the precise function is a gap in the public record.



Herman

It's one of the genuine gaps. There are a few.



Corn

What else is in the trailer?



Herman

Defensive systems. There are nozzles in the ceiling that can purge the air and fill the trailer with a noxious chemical, to disable anyone who gets inside. There's an inclinometer that triggers expanding, fast-hardening foam if the trailer goes off-level, so the cargo doesn't shift. And some media reports claim there are autonomous weapons systems that can engage attackers even if the crew is dead. That last one I'd treat carefully. It's reported, not confirmed.



Corn

The trailer can't be opened except in an approved security area.



Herman

Not even by the crew. That's the rule. The crew cannot open the trailer. It opens at a secure facility or it doesn't open.



Corn

Which means if something goes wrong on the road, the crew's options are limited.



Herman

Deliberately limited. The design assumption is that the trailer is the last line, and the crew's job is to get it to a place where it can be opened.



Corn

How is the convoy tracked?



Herman

The Transportation and Emergency Control Center in Albuquerque tracks every convoy around the clock, with real-time video. There's a sign-countersign system for authenticating responding law enforcement. If a local officer arrives at the scene of a stopped convoy and gives the wrong countersign, the NNSA guidance to that officer is to take cover.



Corn

Take cover from whom?



Herman

From the convoy. The assumption is that if you don't have the countersign, you might be part of the problem.



Corn

That's a remarkable instruction to give a police officer.



Herman

It's a remarkable system. It's built for a scenario where the threat is a coordinated ambush, and in that scenario a person approaching the convoy who can't authenticate is a threat until proven otherwise.



Corn

Travel rules.



Herman

Maximum sixty-five miles per hour, even if the posted limit is higher. No travel in inclement weather. Weather checks every two hours. Couriers can't exceed thirty-two hours of continuous travel without eight hours of bed rest.



Corn

Thirty-two hours is a long shift.



Herman

It is. And there's an emergency power that goes with all this. The Department of Energy can declare a National Security Area around a threatened shipment. It's a limited form of martial law.



Corn

Meaning?



Herman

Meaning the DOE can restrict movement in a defined area around a convoy that's under threat. It's narrow, it's temporary, and it exists.



Corn

Now the part Daniel kept circling. Civilian roads.



Herman

The vehicles are unmarked in the sense that they carry no special livery. They're purpose-built to look like ordinary tractor-trailers. But j.b. crawford, who wrote a long technical history of OST, points out they're about as subtle as a Crown Vic with a bull bar.



Corn

Which is to say, not subtle at all if you know what you're looking at.



Herman

Dark GMC box trucks with US Government E plates. Push bumpers. Spotlights. They don't go faster than sixty, and they only operate during the day in good weather.



Corn

So if you see a convoy of dark trucks with government plates moving slowly on a clear day, escorted by Suburbans, that might be what you're looking at.



Herman

That might be exactly what you're looking at. Which is why people post them to Reddit.



Corn

What's the accident record?



Herman

Over a hundred million miles of over-the-road experience with no fatality and no radioactive release. That's the headline number.



Corn

And the exceptions?



Herman

There's essentially one road accident involving an OST convoy. December 1996, Nebraska. The convoy had gone thirteen years without an accident. Then it hit an unexpected ice storm. A tractor-trailer skidded off the road and rolled onto its side. It was carrying two nuclear bombs.



Corn

Jostled them.



Herman

No release, no detonation, no injuries of consequence. But the truck was on its side and the bombs had moved.



Corn

Was that the only one?



Herman

There's also an incident in Oregon in the early eighties where an escort vehicle was forced off the road by a drunk driver. That's the other one that shows up.



Corn

A drunk driver is the closest the US nuclear arsenal has come to a road incident.



Herman

On the public record, yes.



Corn

Let's talk about the White Train, because that's the part I didn't know.



Herman

From the nineteen fifties until 1987, nuclear weapons moved by rail. Armored boxcars with turret cars and armed guards. It was called the White Train. Maximum speed thirty-five miles per hour.



Corn

Why so slow?



Herman

Security. A train is predictable. It follows a fixed route on a published schedule. The White Train's defense was armor and firepower, not speed or surprise.



Corn

And it ended.



Herman

It ended in 1987, and the reason is protests. Over three hundred communities along the route organized. There was a case in 1985 in Bangor, Washington, where nineteen demonstrators were acquitted of conspiracy charges. The publicity was relentless. The Department of Energy eventually concluded that rail transport wasn't worth the attention.



Corn

So activism killed the White Train.



Herman

Activism killed the White Train. And from 1987, all land transport went by semi-trailer.



Corn

Which raises the question. Was the train safer?



Herman

Arguably yes. A train on a fixed route with armor and turret cars is a more defensible platform than a truck on a highway. But the train was visible. Everybody knew where it was going. The truck is flexible, unpredictable, and easier to obscure.



Corn

So the US traded a safer platform for a less visible one.



Herman

It traded a safer platform for a less visible one, and the trade was driven by public pressure, not by a security assessment. That's the part that's interesting. The logistics of the nuclear arsenal were shaped by protesters.



Corn

Now the future. There's a plan to expand something.



Herman

Inkstick reported in February that NNSA plans to ship plutonium pits across US interstates without clearly informing residents. The expanded transport zone would run through metro areas. Atlanta, Memphis, Oklahoma City.



Corn

Pits, not warheads.



Herman

Plutonium pits. The core of a warhead. They're produced at Los Alamos, and they have to get to Pantex for assembly. That's a long drive through populated country.



Corn

And the objection?



Herman

Dr. Edwin Lyman of the Union of Concerned Scientists calls it the weak link in the chain of nuclear security. Dr. Robert Rosner, who used to direct Argonne National Laboratory, put it this way. We've been moving this stuff since the Cold War, and we've never had a major accident. But the system depends on secrecy. If we have an accident, that veil will be lifted.



Corn

That's the whole tension in one quote. The safety record is excellent, and the system depends on nobody looking too closely.



Herman

And Sean Manning, writing in Inkstick, made the point that nukes do not merely exist in a post-apocalyptic world. They are driving past kids biking on interstate service roads.



Corn

Which is Daniel's point exactly. He kept circling the fact that this happens on civilian roads.



Herman

Because it does. The road is the road. There's no separate nuclear highway.



Corn

There's one more thing I want to get into, and then I think we're close to the end.



Herman

Go.



Corn

The 2017 LA Times investigation into OST.



Herman

That's the uncomfortable part. The investigation found the agency understaffed. Couriers averaging about seventy-five hours a week. High turnover. And a 2010 DOE investigation that found widespread alcohol problems among the courier force.



Corn

Seventy-five hours a week driving nuclear weapons.



Herman

Under a thirty-two-hour continuous limit, so it's not seventy-five hours behind the wheel. But seventy-five hours on duty, in total, across a week. That's a lot.



Corn

And turnover.



Herman

High. Which means the people with the most experience are leaving, and the people replacing them have less.



Corn

So the system that has never had a fatal accident is running on people who are tired.



Herman

That's the framing I'd resist, slightly. The system has never had a fatal accident because the protocols are ruthless. But the protocols depend on people following them, and people who are tired follow protocols less reliably.



Corn

Which is where I want to hand it over, because I think there's someone at this desk who has seen something like this from the inside.



Hilbert

The sanders were added after a convoy got stuck.



Corn

Sorry?



Hilbert

The automatic sanders on the trailer. The ones that lay grit down on ice. They weren't in the original design. They were added after a convoy got caught on a mountain pass in the winter. Late two thousands, I think. The crew had chains, but the chains weren't enough, and the truck couldn't move. So they walked to a gas station and bought cat litter. Fifty-pound bags. They spread it under the drive wheels and got the truck moving again. Took them about four hours. The warhead was never at risk. The crew got a commendation for improvisation.



Herman

Cat litter.



Hilbert

It's clay. It works. The point is that the truck isn't the thing that saved them. The truck is impressive, don't get me wrong. Twelve-inch doors, run-flat tires, the foam. But the thing that got them off that pass was four guys with a bad idea and a bag of cat litter. The system works because of the people in it, not because the hardware is magic.



Corn

That's a correction to what Daniel said. He called the truck virtually indestructible.



Hilbert

The truck is close to indestructible. The situation isn't. And the difference between those two things is a person deciding what to do at four in the morning on a mountain pass.



Herman

I'd push back on one thing, and I think you'd agree with me. The seventy-five-hour weeks and the turnover aren't a footnote. If the system depends on people, and the people are exhausted, then the system has a real vulnerability that the armor doesn't address.



Hilbert

I don't disagree. I'd just say the vulnerability has been there since 1975 and the record is still clean. That's not luck. That's a culture.



Corn

A culture of what?



Hilbert

Of not improvising unless you have to. Of doing the checklist. The cat litter story is funny because it's the exception. The rule is that the crew does exactly what the book says, every time, and the book is very long.



Herman

Which connects to something we said earlier. Ruthless adherence to protocol.



Hilbert

That's the phrase. It's in their own doctrine. Remain unpredictable, and adhere ruthlessly to the deductive process. It sounds like a slogan. It's actually a job description.



Corn

I want to take that somewhere you might not have thought of.



Hilbert

Go on.



Corn

If the culture is the safeguard, then the expansion plan is the risk. More miles, more routes, more metro areas, more crews. The culture doesn't scale by adding trucks. It scales by hiring and training people, and the investigation says they were already short.



Hilbert

That's fair. I hadn't thought about it that way. The cat litter works because the guy who thought of it had been doing the job for fifteen years. You can't buy that with a bigger budget.



Herman

All right. Let's do the misconception, and then we'll close.



Corn

The most common wrong belief about this topic is that the physics package is the weapon. That the bomb is the physics package and everything else is packaging.



Herman

It's the reverse. The physics package is often a fraction of the weapon's length, and for the current generation, the W76, the W87, the W88, the physics package has never been publicly shown. What you've seen in photographs is the reentry vehicle. The cone. The dunce cap.



Corn

So the thing everyone recognizes is the casing, and the thing that actually matters is smaller and classified.



Herman

Smaller and classified. That's the correction.



Corn

Here's what I'm left with. We don't actually know how often warheads move. There's no public figure. The best proxies are the three million miles a year and the thousand W76s that went from Bangor to Amarillo. The role of the aircraft isn't documented. The physics packages of the current warheads aren't documented. And the plan to move more plutonium pits through Atlanta and Memphis and Oklahoma City is real, and the safety record that makes it defensible is real, and Rosner's warning is the thing that sits between them. If there's an accident, the veil lifts.



Herman

The most secretive objects on Earth are also the most visible. Driving past you on the interstate, flanked by Suburbans, while you're on your way to get groceries.



Corn

That's the whole episode. The secrecy is thinner than you'd think, and the thing that keeps it working is a crew following a checklist at four in the morning.



Herman

Thanks to Hilbert Flumingtop, our producer.



Corn

This has been My Weird Prompts. If you enjoyed this one, leave us a review wherever you listen. It helps.



Herman

We'll be back soon.



Corn

See you then.