S03E15 - GPS: How the Military Built Your Fitness Tracker

The Multiverse Employee Handbook - Season 3

The *Multiverse Employee Handbook* has this to say about GPS:

It is humanity's quiet insistence that the universe should, at all times, know exactly where you are, even when you yourself have only a vague emotional sense of direction.

Global Positioning Systems work by consulting a small constellation of extremely punctual objects orbiting the planet, all of which spend their days shouting the time at Earth with atomic precision. Your device listens, compares notes, performs several relativistic corrections that would alarm most philosophy departments, and then calmly announces that you should "turn left in 200 meters," as if space and time had always been arranged for your convenience.

The Handbook notes that this arrangement only functions because Einstein was correct, clocks in orbit are slightly untrustworthy. Without corrections, GPS would drift by kilometers each day, gently guiding users into lakes, forests, or the wrong side of town.

Originally designed for military navigation, GPS has since been repurposed for locating coffee shops, avoiding traffic, and proving—definitively—that you were not, in fact, late; the map simply changed its mind. It has given humanity the illusion of certainty while preserving just enough error to ensure family arguments on road trips still continue.

There is also the matter of dependence. Prolonged GPS use has been shown to weaken internal navigation instincts, particularly the ancient human skill of saying "I think it's this way" with unearned confidence. Entire generations now trust satellites more than memory, intuition, or that one friend who insists they "know a shortcut."

In summary, GPS is a triumph of physics, engineering, and collective agreement, allowing a small species on a moving planet to know where it is at almost all times. It does not, however, explain why you went there, or what you're meant to do once you arrive.

You're tuned into The Multiverse Employee Handbook.

Today, we're exploring GPS—the satellite system that the U.S. military built to guide missiles and humanity promptly repurposed for finding the nearest coffee shop, using atomic clocks, relativistic corrections, and the kind of logic that only makes sense if you're comfortable with the fact that your phone knows where you are better than you do.

It's a system where 31 satellites orbit at 20,000 kilometres, travelling at 14,000 kilometres per hour, each carrying atomic clocks worth millions, all so you can prove to your spouse that yes, you did turn left when instructed, the restaurant simply moved.

We'll explore how the military spent $12 billion building infrastructure for nuclear submarines, only to watch civilians use it to track their morning jogs. We'll examine why the same atomic precision required to target intercontinental ballistic missiles is now required to ensure your pizza arrives at the correct door.

And we'll discover how a technology once considered "strictly military" became so thoroughly civilian that even the Russians—who built their own positioning system—still use American GPS because sometimes your competitor's infrastructure is just too convenient to ignore.

But first, gather 'round the satellite tracking station, my directionally challenged colleagues, for a tale about the brief, glorious era when humanity discovered it could print the future—and then immediately get lost anyway.

The year was 1996. MapQuest had just launched with a premise so revolutionary it would take approximately eight years before anyone realised how absurd it actually was: type in two addresses, click "Get Directions," and print the results.

Sarah Mitchell was running late for her cousin's wedding, clutching six pages of computer-printed directions that she'd stapled together with the confidence of someone who had tamed technology itself.

The directions were aggressively specific. "Head east on Maple Street toward Oak Avenue, zero-point-three miles. Turn right onto Oak Avenue, one-point-seven miles. Turn left onto Highway 47, eight-point-two miles."

She'd placed them on the passenger seat, carefully oriented so she could glance down between watching the road. This seemed tremendously clever.

It was not tremendously clever.

By page three, she'd missed a turn. Not because the directions were wrong, but because she'd been reading page four while driving past the turn on page three. The pages had shuffled. Or she'd skipped one. Or the computer had simply lied about distances.

She pulled into a petrol station, staring at direction number fourteen: "Turn right onto Riverside Drive."

Where was she now? Somewhere between direction eleven and direction fourteen, probably. Unless she'd accidentally completed direction fourteen without realising it, in which case—

"Lost?"

A woman in her sixties appeared, watching with the expression of someone who had seen this exact scenario dozens of times. "MapQuest?"

"How did you know?"

"The colour printingl. I'm Helen. I work at the library. We print these all day. Also popular: people coming back after the first ones failed."

Helen pulled out a pen and wrote on the back of Sarah's directions: "Right out of station. Three miles. Large sign on left."

Two sentences. Zero ambiguity.

Sarah made it to the wedding with six minutes to spare.

This scene repeated itself thousands of times throughout the late 1990s. People printed directions. People missed turns. People pulled over, reshuffled pages, trying to determine which numbered step they were currently failing to complete.

And yet, it was revolutionary.

For the first time, you didn't need an atlas. You didn't need to call ahead and ask for directions. The computer calculated the route. The computer measured distances. The computer knew—or at least claimed to know—the optimal path between two points.

The fact that humans couldn't execute these instructions whilst simultaneously operating vehicles was, in retrospect, a significant design flaw. But the principle was sound.

It just needed one small improvement: the computer needed to be in the car with you, telling you when to turn, instead of silently judging you from a pile of increasingly disorganised paper on the passenger seat.

By 2001, MapQuest was serving eighty-two million directions per day. Eighty-two million daily opportunities for humans to miss step eleven whilst reading step twelve.

By 2008, the iPhone 3G included GPS. Turn-by-turn navigation, live on your phone, updating as you drove. No printing. No pages to shuffle. No missed turns on step eleven.

The era of printed directions ended almost immediately.

Sarah Mitchell, years later, used her phone's GPS without thinking about it. The idea of printing directions seemed absurd in retrospect. Charmingly primitive.

She'd kept those MapQuest directions, though. Tucked in a box of memorabilia. Six pages of obsolete navigation, stapled together, a monument to the three-year period when humanity tried to bridge the gap between stationary computers and mobile humans by printing things and hoping for the best.

It had worked just well enough to prove people wanted computer-calculated routes. They just needed the technology in the car with them.

Which, of course, someone had suggested in 1993. Something about phones knowing where they were. Turn-by-turn navigation. Routes calculated automatically.

But that had been filed away as impractical.

In the break room at Quantum Improbability Solutions, a senior executive was telling this story to a group of younger employees over lunch.

"MapQuest was the missing link," he said. His hair maintained perfect cubic geometry despite the fluorescent lighting. "It proved people wanted the service. They just couldn't execute it because the computer was at home and they were in a car. Obvious in retrospect."

"When did you realise that?" one of the junior developers asked.

"1993," the executive said. "I tried to explain it to my previous employer. They told me we had maps and they worked fine."

"What happened?"

"I left. Came here. We built the infrastructure for location-based services whilst they were still filing reports about why civilians didn't need GPS."

He took a sip of coffee.

"The satellites were already up there. The technology was solved. The only thing missing was imagination—seeing what people would do once the barriers disappeared. MapQuest was the bridge. It was absurd and it worked poorly, but it proved the concept."

He stood to leave, pausing at the door.

"The lesson is that when the military builds infrastructure for one purpose, someone should always ask what civilians might do with it. Because they'll find uses nobody imagined. Usually involving pizza delivery, coffee shops, or proving they weren't actually late—the map simply changed its mind."

And with that, the square haired boss returned to his office, where a framed slide from 1993 hung on the wall.

The title read: "Civilian Applications of GPS Technology."

Below it, in smaller text: "They Told Him It Wouldn't Work."

On his desk, half-buried under quarterly reports, was a stapled set of MapQuest directions from the 90s.

He'd kept them as a reminder: sometimes the bridge between vision and reality is six pages of badly formatted directions that get you lost but prove you were heading in the right direction all along.

And that brings us to the fascinating science behind the navigation system that almost stayed military forever—and the spectacular failure of imagination that nearly kept it there.

Unlike Star Trek's magical subspace positioning or Doctor Who's temporal coordinates that somehow always land the TARDIS in London, GPS follows the elegant but mundane physics of signal timing and geometry.

The concept is simple: if you know exactly when a satellite transmitted a signal, and exactly when you received it, you can calculate how far away that satellite is. Light travels at 299,792,458 metres per second—not negotiable, not approximate, just the speed of causality itself. Multiply the travel time by the speed of light, and you have your distance from that satellite.

One satellite gives you a sphere of possible locations. Two satellites narrow it to a circle. Three satellites give you two possible points—one usually being somewhere ridiculous like the centre of the Earth. Four satellites resolve all ambiguities and provide precise three-dimensional positioning.

Simple geometry. Relentless arithmetic. Atomic clocks maintaining nanosecond precision because a timing error of one microsecond translates to a position error of three hundred metres.

But here's what that executive understood in 1993 and the military didn't: the hard part wasn't the physics. The physics was solved. The hard part was imagining what ordinary people would do with the ability to know exactly where they were.

The military saw GPS as a targeting system. He saw it as something far stranger: the infrastructure for industries that didn't exist yet.

When we return from this brief orbital correction, we'll dive deeper into why the Department of Defence built GPS in the first place, how atomic clocks became unexpectedly essential to capitalism, and why even Russia—builder of GLONASS, their own positioning system—still uses American GPS satellites for critical applications because sometimes your competitor's infrastructure is just too convenient to ignore.

Welcome back, my positionally uncertain colleagues!

While you were away, we've been calculating the probability that anyone in 1993 correctly predicted GPS would be used primarily to track jogging routes and argue about restaurant locations. The probability, it turns out, approaches zero.

The problem GPS solved was fundamentally military: how do you navigate when you can't trust anything on the ground?

Pre-GPS navigation was a collection of imperfect compromises. Ships used celestial navigation—literally measuring star positions with sextants, as if we were still in the age of sail. Aircraft relied on ground-based radio beacons, which meant revealing your position to anyone listening. Nuclear submarines attempting to launch ballistic missiles needed to know their exact location, but surfacing to get a position fix rather defeated the purpose of being a *stealth* weapons platform.

The Cold War made navigational independence a strategic priority. If ground stations could be destroyed or compromised, you needed something in space, broadcasting continuously, immune to terrestrial interference.

The concept emerged in the 1960s: satellites with known orbits broadcasting precise timing signals. The Transit system proved this could work, but only if you were stationary—fine for ships, useless for aircraft or missiles. GPS improved on this dramatically: continuous positioning anywhere on Earth, for moving receivers.

But it required atomic clocks in orbit. Caesium atomic clocks, accurate to nanoseconds, costing millions of pounds each. Because here's the brutal arithmetic: light travels 300 metres per microsecond. A one-microsecond timing error translates directly to a 300-metre position error. If you want ten-metre accuracy, you need nanosecond precision.

And then there's Einstein. The satellites orbit at 20,000 kilometres, travelling at 14,000 kilometres per hour. At those speeds and altitudes, time runs differently than it does on Earth's surface—both special relativity and general relativity apply. The clocks on the satellites tick faster than clocks on the ground by about 38 microseconds per day.

That doesn't sound like much until you remember: 38 microseconds equals 11 kilometres of position error per day. Without relativistic corrections built into the system, GPS would be useless within hours.

Einstein's theories aren't optional. They're in the navigation equations.

The military spent $12 billion deploying the original 24 satellites. Ongoing maintenance costs billions per year. And for decades, they deliberately degraded civilian signals through something called Selective Availability—introducing intentional errors so civilian accuracy was only 100 metres whilst military accuracy remained 10 metres.

The theory was sound: prevent enemies from using GPS for precision weapons. The reality was that differential GPS techniques—comparing signals from multiple receivers—could overcome this degradation anyway. President Clinton ended Selective Availability in May 2000, and civilian accuracy immediately improved tenfold.

Every location-based service you use today depends on that decision.

And here's the Cold War irony: Russia developed GLONASS, their own positioning system, during the Soviet era. After the Soviet collapse, they struggled with funding and maintenance. Russian commercial aviation and shipping often use American GPS alongside GLONASS because GPS was already working, already global, already free.

Even competitors use each other's infrastructure when it's too convenient to ignore. Geopolitics becomes complicated when your civilian economy depends on your rival's satellites.

The military wanted targeting infrastructure. They built the internet of location. The return on investment is immeasurable—an entire civilian economy built on free access to signals that cost billions to maintain.

Sometimes the most strategic infrastructure is the kind you let everyone use.

The civilian GPS revolution happened in stages, each one proving that the 1993 predictions weren't ambitious enough.

Early GPS receivers were expensive, bulky, and power-hungry. They required clear line-of-sight to satellites, which meant they worked brilliantly in open fields and terribly near buildings. The first commercial units targeted maritime and aviation applications—industries where "knowing where you are" was worth paying thousands of pounds for a device the size of a briefcase. Hikers and surveyors followed. Garmin was founded in 1989, releasing consumer handheld GPS devices throughout the 1990s. But these remained niche. Expensive toys for enthusiasts who enjoyed knowing their precise coordinates whilst standing on mountains.

Then came MapQuest in 1996—online maps that people could print. The computer calculated routes and produced turn-by-turn directions you could take with you. Everyone who drove anywhere in the early 2000s printed MapQuest directions, usually in colour, usually stapled together, usually resulting in getting lost around step eleven. This proved the concept: people wanted computer-calculated routes. They just needed the computer in the car with them.

The smartphone was the inflection point. GPS chips became small and cheap enough for mobile phones. The iPhone 3G, launched in 2008, included GPS as standard. Google Maps worked with live positioning. Turn-by-turn navigation became expected, not luxury. Car GPS devices went from £500 premium products to obsolete in under a decade. Why buy a dedicated device when your phone did the same thing better?

And then the industries that executive predicted in 1993 started appearing, almost exactly as described. Ride-sharing—Uber and Lyft are impossible without real-time positioning of both car and passenger. Delivery tracking lets you follow your pizza in real-time. Precision agriculture uses GPS for centimetre-accurate fertiliser application. Fleet logistics optimises global supply chains. Location-based advertising—the "dystopian" idea dismissed in 1993—became Google's entire business model. Fitness tracking created a billion-pound industry from people wanting to know how many steps they've taken. Financial markets use GPS for microsecond time synchronisation across exchanges. Emergency services use automatic location from 999 calls, saving lives regularly.

But perhaps nothing demonstrated GPS's complete cultural penetration quite like Pokémon GO. In 2016, millions of people wandered around cities hunting imaginary creatures whose locations were tied to GPS coordinates. The game made nearly a billion dollars in its first year by answering a question nobody had thought to ask: what if we used satellite navigation designed for nuclear missiles to make people walk to specific locations to collect fictional animals? The military spent $12 billion building infrastructure so teenagers could catch Pikachu in the park. Both require atomic clock precision. Only one makes any logical sense.

Multiple positioning systems now operate simultaneously: GPS from America, GLONASS from Russia, Galileo from Europe, BeiDou from China. Modern smartphones use signals from all systems at once, achieving sub-metre accuracy without specialised equipment. They're part of a much larger orbital infrastructure that's emerged over the past two decades.

Low Earth orbit has become remarkably crowded. There are currently over 9,000 active satellites orbiting Earth—a number that's increased dramatically in just the past five years. SpaceX's Starlink constellation alone consists of over 5,000 satellites providing global internet coverage, with plans to launch thousands more. Amazon's Project Kuiper, OneWeb, and others are building competing networks. These massive constellations promise internet access anywhere on Earth, from remote villages to ocean-going ships.

But amongst all this orbital infrastructure—communication satellites, weather monitoring, scientific instruments, and frankly quite a lot of space debris—GPS remains arguably the most strategically important. It's the invisible utility that everything else depends on. Your Starlink connection might tell you where the nearest coffee shop is, but GPS tells your phone where you are. Navigation satellites don't provide internet access or stream videos, but they provide the fundamental answer to "where am I?" that makes everything else work.

The free global utility that underpins modern civilisation. Built for targeting missiles. Used for finding restaurants, tracking fitness, coordinating markets, and catching Pokémon. Both require atomic clock precision. Only one required imagination to recognise the other was possible.

Well, my precisely located colleagues, we've reached the end of another quantum navigation exercise. Today we've learned that in the multiverse of strategic foresight, every military technology exists in a superposition of "single-purpose system" and "infrastructure for industries we haven't imagined yet" until someone with vision collapses the wavefunction.

We've discovered that GPS—designed to tell missiles where to explode—became the foundation for telling humans where to eat, how to exercise, when to buy stocks, which route avoids traffic, and where to find imaginary creatures in parks. The same atomic clocks that ensure nuclear submarines know their launch position now ensure your food delivery app knows which apartment building you're in.

That executive understood something in 1993 that his previous employer didn't: the hard part wasn't the technology. The military had solved that. The hard part was imagination—seeing what ordinary people would do with extraordinary capabilities once the barriers to access disappeared.

His former colleagues saw a $12 billion missile guidance system. He saw turn-by-turn navigation, location-based advertising, ride-sharing, precision agriculture, and financial market synchronisation. They filed his report in the archive. He went to work for the competitor.

Somewhere in orbit, 31 American GPS satellites—more than the original 24—continue broadcasting timing signals with nanosecond precision, joined by dozens more from other nations' constellations. They orbit at 20,200 kilometres, moving at 14,000 kilometres per hour, each carrying atomic clocks worth millions of pounds. And they power everything.

Your commute. Your pizza delivery. Your morning run. Your stock trades. Your emergency call. Your combine harvester. Your argument about which restaurant to try. Your quest to catch a Pikachu in the park.

The military built a constellation to target enemies. Humanity used it to target restaurants. Both require atomic clock precision. Only one requires imagination to realise the other was possible.

Want to explore more quantum corporate chaos? Visit us at multiverseemployeehandbook.com where you'll find fascinating science news and deep dives into the technologies that changed the world whilst everyone was looking the other way.

And if you've enjoyed today's positionally-aware adventure, why not share it with a fellow navigation enthusiast? Perhaps you know someone who remembers printing MapQuest directions and getting lost around step eleven, or someone who's never lived in a world without GPS and might want to appreciate that satellites are why their phone knows which way is north. Spread our signal like satellite broadcasts across the electromagnetic spectrum!

This is your quantum-coherent correspondent, reminding you that in the multiverse of strategic planning, we're all just that executive in 1993—seeing futures that seem obvious in retrospect but impossible to convince anyone about in the present.

And according to the latest satellite telemetry, those MapQuest directions from 1996 are still in that box of memorabilia, six pages of obsolete navigation proving that sometimes the bridge between vision and reality is a stack of badly formatted directions that get you lost but at least point you in the right direction.

The satellites, indifferent to corporate restructuring and civilian innovation, continue broadcasting. They've been shouting the time at Earth for decades now, like the universe's most punctual town criers, completely unaware that they're helping teenagers find Pokémon, traders synchronise transactions, and families argue about whether the restaurant was supposed to be on the left or the right.

Though if we're being honest, it's always on the left. The map simply changed its mind.