MY WEIRD PROMPTS

Podcast Transcript

EPISODE #74

The High-Stakes Tech of Modern Missile Warfare

Published December 22, 2025 • Runtime: 27:51

https://myweirdprompts.com/episode/missile-warfare-tech-navigation/

EPISODE SYNOPSIS

Dive into the high-stakes game of modern missile warfare with hosts Corn and Herman. They dissect the technical cat-and-mouse battle between nations like Israel and Iran, unraveling how advanced weaponry navigates at hypersonic speeds amidst sophisticated electronic warfare. Discover why GPS isn't always king, the mind-bending precision of Inertial Navigation Systems (INS), and the ethical dilemmas of automated defense. This episode explores the cutting-edge engineering behind hitting a "bullet with a bullet" and the surprising vulnerabilities and strengths of these complex systems.

DANIEL'S PROMPT

Daniel

I'd like to discuss navigation in modern warfare, specifically in the context of the conflict between Israel and Iran. I've been researching the engineering behind Iranian missiles—their incredible speeds, altitudes, and the extreme precision required for interception. This raises several questions about how these systems navigate. Since Israel uses GPS spoofing and jamming to disrupt threats, and GPS is primarily a U.S.-controlled technology, what safeguards are in place to prevent adversary forces from using these navigation systems? Additionally, I'm interested in Inertial Navigation Systems (INS), which rely on internal sensors rather than external signals. How are these systems engineered to maintain precision at such high speeds, and how do they serve as a spoof-proof alternative to GPS?

TRANSCRIPT

Corn

Welcome to My Weird Prompts! I am Corn, your resident sloth and lover of all things curious. I am joined as always by the one, the only, Herman Poppleberry. Today we are diving into a really heavy, high stakes topic. Our producer, Daniel Rosehill, sent us a prompt that gets into the nitty gritty of modern warfare navigation, specifically looking at the technical cat and mouse game happening between Israel and Iran.

Herman

It is a pleasure to be here, Corn. And yes, Herman Poppleberry is ready to get into the weeds. This prompt is fascinating because it touches on something most people take for granted. We use GPS to find a coffee shop, but when you are talking about ballistic missiles and hypersonic speeds, the physics and the engineering change completely. It is not just about where you are, it's about how you know where you are when the whole world is trying to lie to your sensors. As a donkey, I appreciate a firm sense of ground truth, and that is exactly what we are discussing today.

Corn

Right, and it is pretty wild to think about. We are talking about missiles flying at thousands of miles per hour, and on the other side, you have these sophisticated defense systems trying to knock them out of the sky. Daniel’s prompt specifically mentions GPS spoofing and jamming. I mean, I have seen reports of people in Tel Aviv opening up Google Maps and seeing their location as being in Beirut or Cairo. That has to be intentional, right?

Herman

Absolutely intentional. It is called electronic warfare. But Corn, we have to be careful with the terminology. Jamming is like someone screaming in your ear so you can't hear your music. Spoofing is different. Spoofing is like someone whispering the wrong lyrics into your ear so you think you are hearing a different song. Israel has been aggressively using both to throw off the guidance systems of drones and missiles. But here is the catch, and this is where the prompt gets really interesting. Most high end Iranian missiles do not actually rely on GPS the way your phone does.

Corn

Wait, really? I thought GPS was the gold standard for everything now. If they aren't using GPS, how are they hitting targets from hundreds of miles away with such precision?

Herman

Well, that is the big misconception. If you build a multi million dollar missile, you do not want it to become a paperweight just because the United States decides to turn off a satellite or because a jammer is nearby. That is where Inertial Navigation Systems, or INS, come in. This is old school tech that has become incredibly high tech.

Corn

Okay, hold on. I want to get into the INS stuff, but I have a question about the GPS side first. The prompt mentions that GPS is essentially U.S. controlled. If I am a country that is not exactly on friendly terms with the U.S., why would I ever build a weapon that relies on their satellites? Can't the U.S. just, I don't know, flip a switch and make the signal go fuzzy for certain areas?

Herman

They can, and they have. It is called Selective Availability, though the U.S. military officially stopped using that specific method in two thousand. However, they still have the capability to deny GPS signals in specific geographic blocks. But Corn, you are oversimplifying the global landscape. There isn't just one GPS. You have the Russian GLONASS, the European Galileo, and the Chinese BeiDou. If you are Iran, you aren't just looking at the American satellites. You are looking at all of them.

Corn

But even then, if you are using someone else's satellites, you are still vulnerable. I mean, if I am Iran, I wouldn't want to bet my entire military strategy on a Russian satellite staying online during a global conflict.

Herman

Exactly. Which brings us back to the heart of the engineering question. How do you keep a missile on track without any outside help? The answer is the Inertial Navigation System. Imagine you are in a completely dark room. You know exactly where you started. If you count your steps and keep track of every turn you make, you can theoretically know where you are at any moment. That is INS. It uses accelerometers and gyroscopes to measure every tiny movement of the missile.

Corn

I don't know, Herman. That sounds prone to error. Like, if I take a slightly longer step in that dark room, or if I trip a little bit, by the time I get to the other side of the house, I am going to be way off. Wouldn't a missile traveling at Mach five have the same problem? A tiny mistake at the start becomes a huge miss at the end.

Herman

You are hitting on the concept of drift, and you are right to be skeptical. In the old days, INS was bulky and would drift by miles over long distances. But modern engineering has changed the game. We are talking about Ring Laser Gyros and Fiber Optic Gyros. These things measure the interference patterns of light to detect rotation. They are insanely precise. We are talking about sensors that can detect a fraction of a degree of movement.

Corn

But still! Mach five! That is over three thousand eight hundred miles per hour. At those speeds, the heat alone must be doing weird things to the sensors. I read that the friction of the air turns the atmosphere around the missile into plasma. Does a gyroscope even work when it is encased in a fireball?

Herman

That is a great point, and it is actually one of the biggest hurdles in hypersonic flight. The heat doesn't just mess with the sensors; it can actually block radio signals entirely. This is why INS is not just an alternative to GPS, it is a requirement. If you are in a plasma sheath, GPS signals can't even get through to the antenna. So the system has to be entirely self contained. The engineering challenge is shielding those sensors from the vibration and the thermal expansion. If the frame of the missile warps even a millimeter due to heat, it can throw off the alignment of the gyros.

Corn

See, this is where I think the whole precision thing becomes a bit of a myth. We see these videos of interceptions over Israel, like the big attack back in April two thousand twenty four. Iran launched hundreds of drones and missiles. If their INS is so good, why did so many get intercepted? Or why did some miss?

Herman

Well, Corn, don't confuse navigation with invulnerability. You can know exactly where you are and still get shot down by an Arrow three interceptor. But to your point about missing, no system is perfect. Iranian missiles like the Kheibar Shekan or the Fattah are claimed to have high precision, but in reality, they often use a combination of systems. They use INS for the midcourse flight, and then they might switch to an optical seeker or a radar seeker for the final terminal phase.

Corn

Wait, so they do use outside signals?

Herman

Sometimes. But that is the part that can be jammed. If the missile is looking for a specific landmark using a camera, and Israel puts up a massive smoke screen or uses lasers to blind the camera, the missile falls back on its INS. It is all about layers of redundancy.

Corn

It sounds like a giant game of "I know that you know that I know." Israel jams the GPS, so Iran uses INS. Iran uses a camera for the final hit, so Israel jams the camera. It’s exhausting just thinking about it.

Herman

It is the pinnacle of engineering competition. But let's take a quick break before we get into how these interceptors actually do the math to hit a bullet with a bullet.

Corn

Good idea. Let's take a quick break from our sponsors. Larry: Are you tired of your neighbors looking at your backyard? Do you wish you could just disappear without actually leaving your lawn chair? Introducing the Stealth-O-Matic Personal Cloaking Shroud! This is not a blanket, folks. This is a proprietary blend of reflective polymers and repurposed microwave mesh that renders the wearer virtually invisible to the naked eye and most common household pets. Perfect for avoiding that guy down the street who wants to talk about his lawn mower. Warning: Do not use near hummingbirds or high voltage power lines. The Stealth-O-Matic is the only way to achieve true domestic solitude. It’s light, it’s breathable, and it’s probably legal in most states! BUY NOW!

Herman

...Alright, thanks Larry. I am not sure I would trust a microwave mesh blanket, Corn.

Corn

I don't know, Herman, sometimes I really don't want to talk to my neighbors. A cloaking shroud sounds like a sloth's dream. Anyway, back to the missiles. We were talking about the precision of these things. Daniel’s prompt mentioned the extreme precision required for interception. When Israel’s Arrow system or the Iron Dome goes after something, how do they "see" it if the target is using all this spoof-proof tech?

Herman

That is the other side of the coin. The interceptor doesn't care about the target's GPS. The interceptor uses its own powerful ground based radar, like the Green Pine radar. It tracks the physical object in the sky. It calculates the trajectory based on physics. Once the interceptor is launched, it has its own onboard seekers. It is basically a dog chasing a tennis ball, except the tennis ball is moving at six times the speed of sound and the dog is a multi million dollar computer.

Corn

But if the incoming missile is maneuvering, does the math even work? I mean, if I am a missile and I know an interceptor is coming, can't I just... move?

Herman

That is exactly what the newest generation of missiles tries to do. These are called Hypersonic Glide Vehicles. Instead of following a predictable arc like a tossed baseball, they skip along the atmosphere. This makes the math a nightmare for the defense system. You have to calculate the intercept point in real time while the target is actively changing its path.

Corn

I'm going to be honest, Herman, this feels like we are reaching a point where the tech is too fast for humans to even be involved. Are there people making these decisions, or is it just computers talking to computers?

Herman

In the heat of the moment? It is almost entirely automated. The speeds are too high for human reaction times. A human might give the "go" command to engage, but the actual steering and timing are handled by algorithms. And that leads to a really interesting ethical and technical dilemma that I think people often overlook. If the algorithm makes a mistake because it was spoofed by a fake signal, who is responsible?

Corn

See, that's where I disagree with the "automated is better" crowd. You say the math is too fast for humans, but humans are the ones who have to deal with the consequences if the math is wrong. If a defense system misidentifies a civilian plane as a maneuvering missile because the electronic warfare environment is so messy, that's a catastrophe. We've seen that happen before.

Herman

You're right, it has happened. But the alternative is having no defense at all against something moving that fast. You can't have a guy with a joystick trying to hit a Mach eight projectile. It's a forced move. The engineering is pushed to these extremes because the threats are at those extremes.

Corn

I still think we over rely on the "black box" of these systems. We talk about INS being "spoof proof," but is it really? If I can't mess with your GPS, can I mess with your gyroscopes? I've heard about acoustic attacks where specific sound frequencies can vibrate a MEMS gyroscope and make it lose its mind.

Herman

That is a very high level, laboratory style attack, Corn. Doing that to a missile in flight through the atmosphere at hypersonic speeds? That is nearly impossible. The sheer noise of the flight would drown out any intentional acoustic interference. For all intents and purposes, a high quality INS is the most secure form of navigation we have. It doesn't listen to anything. It only feels.

Corn

"It only feels." That's poetic, Herman. A bit dark for a weapon of war, but poetic.

Herman

Warfare is often where the most intense engineering happens, unfortunately. But the point Daniel was making in the prompt about the U.S. controlling GPS is vital. It's why you see this massive push for sovereign navigation. It's not just Iran. China is building their own, Europe has theirs. No one wants to be the person in the dark room who doesn't even have their own feet to count steps with.

Corn

Alright, hold that thought. We have a caller. Let's see what Jim from Ohio has to say about all this high tech navigation. Jim, are you there? Jim: Yeah, I'm here. Jim from Ohio. I've been listening to you two eggheads talk about "Ring Laser Gyros" and "Plasma Sheaths" for twenty minutes now and I gotta tell ya, you're missing the forest for the trees. You're talking like this is some futuristic space movie. Back in my day, if you wanted to know where you were going, you used a map and your eyeballs. My neighbor, Dale, tried to use one of those GPS things on his tractor last week and ended up half submerged in the creek. A creek! The man has lived here forty years!

Herman

Well, Jim, a tractor in a creek is a bit different than a ballistic missile crossing international borders. The stakes are slightly higher. Jim: Are they? Tell that to Dale’s insurance company. Look, my point is, you’re talking about all this "spoofing" and "jamming" like it’s some magical wizardry. It’s just radio waves! It’s like when my microwave messes with the Wi-Fi when I’m trying to watch my programs. And another thing, you’re acting like these missiles are so smart. If they’re so smart, why do they need all these "layers"? It sounds to me like the engineers don't trust their own work. It’s like wearing suspenders and a belt. Just pick one! Also, it’s raining here again. Third time this week. My gutters are a mess and the cat won't stop staring at the wall. You guys ever think about the simple stuff?

Corn

We try to, Jim! But when things are moving at Mach five, "simple" kind of goes out the window. Jim: Mach five, Mach shmive. You hit a bird at that speed and your fancy gyro-whatever is gonna have a bad day. You guys spend all this time worrying about the satellites and the sensors, but you forget that the world is a messy place. Dale’s tractor proved that. I don't buy that any of this stuff is as precise as they claim. It’s all marketing for the defense contractors if you ask me. Anyway, I gotta go, the cat just knocked over a lamp.

Corn

Thanks for the call, Jim! Good luck with the gutters and the cat.

Herman

You know, as much as Jim likes to grumble, he actually touched on a real technical point. The "messiness" of the world. In engineering, we call that "noise." And he is right—if an INS system takes a physical jolt, like an explosion nearby or even just extreme turbulence, it can introduce error. That is why they use something called a Kalman Filter.

Corn

A what filter?

Herman

A Kalman Filter. It is an algorithm that basically looks at the data from the sensors and says, "Okay, based on what I know about physics, this one sensor reading seems like garbage, so I'm going to ignore it and trust the other ones." It is a mathematical way of dealing with the "messy world" Jim was talking about.

Corn

So even the sensors don't trust themselves? They need a math program to tell them what's real?

Herman

In a way, yes. It's all about probability. The system is constantly asking, "Where am I most likely to be?" and it updates that guess a thousand times a second.

Corn

That is actually a little bit terrifying. That the precision we talk about is really just a very, very fast series of educated guesses.

Herman

But that is what all navigation is, Corn! Even when you look at a map, you are making an assumption that the map is accurate and your eyes aren't deceiving you. The engineering just makes those guesses much more accurate than yours or mine.

Corn

I don't know, Herman. I think I'm with Jim on the "suspenders and a belt" thing. It feels like we are building these incredibly complex systems to solve problems that we created by building other complex systems. We built GPS, so then we built GPS jammers, so then we built better INS, so then we built interceptors that can see through the jamming... where does it end?

Herman

It doesn't end. It’s a technical evolution. Look at the prompt’s question about safeguards. The U.S. military uses something called M-Code for their GPS. It’s a restricted, encrypted signal that is much harder to jam or spoof than the civilian signal you use on your phone. That is a safeguard. But then the adversary develops a way to spoof even that, or they just build a better INS that doesn't need the signal at all. It is a constant cycle of measure and countermeasure.

Corn

So, for the regular people listening, what is the takeaway here? Because most of us aren't launching missiles or defending against them. Does this navigation war actually affect us?

Herman

It does, actually. A lot of the technology that makes your phone's navigation better comes from this high end military research. Micro-Electro-Mechanical Systems, or MEMS, which are the tiny gyros in your phone, exist because the military wanted to shrink down those big, bulky INS units. But more importantly, the "spoofing" Israel is doing right now is affecting civilian aviation. Pilots in the Middle East have to be much more careful now because their GPS might suddenly tell them they are a hundred miles away from where they actually are. They have to go back to "old school" navigation, using ground based radio beacons and, yes, even maps and their eyeballs.

Corn

That is wild. So the high tech war is actually forcing people to use low tech skills.

Herman

Exactly. Redundancy is the name of the game. If you rely on one thing, you are vulnerable. If you rely on five things, you are much safer. That is the practical takeaway for everyone: don't let your skills atrophy just because you have a fancy gadget.

Corn

I like that. Even a sloth can appreciate a backup plan. I usually have a backup branch in mind if the first one looks a bit shaky.

Herman

A very wise approach, Corn.

Corn

Alright, we are getting close to the end of our time. This has been a deep dive into some pretty intense engineering. We've looked at how missiles navigate without GPS, how INS works by "feeling" movement, and the crazy chess match between Iran and Israel. Any final thoughts, Herman?

Herman

I think it is important to remember that while we talk about these things as "systems" and "engineering challenges," they represent a massive amount of human ingenuity. The same technology that guides a missile can guide a spacecraft to Mars or help a self-driving car navigate a busy street. The context is warfare, but the physics is universal. I just hope we see more of this brilliance used for the Mars stuff and less for the missile stuff as we move forward.

Corn

I couldn't agree more. And I want to thank our producer, Daniel Rosehill, for sending in such a brain-bending prompt. It really makes you think about what's happening in the sky above us that we can't even see.

Herman

It certainly does. And it reminds me that I should probably double check the calibration on my own internal compass. Donkeys are known for their sense of direction, you know.

Corn

Oh, here we go. Herman's superior donkey senses. I'll just stick to my branch, thanks.

Herman

Suit yourself, Corn. But don't come crying to me when your GPS tells you that your tree is in the middle of the ocean.

Corn

Fair point! Well, that is all for today's episode of My Weird Prompts. You can find us on Spotify and anywhere else you get your podcasts. We love exploring these weird, technical, and sometimes grumpy corners of the world with you.

Herman

Indeed. Stay curious, stay skeptical, and maybe keep a paper map in your glove box, just in case. This is Herman Poppleberry, signing off.

Corn

And I'm Corn! See you next time, everyone! Stay slow and stay smart