A New Vision for GPS-Independent Navigation with Skyline Nav AI

Audrey Woods, MIT CSAIL Alliances | July 28, 2025

In August of 2012, a truck driver installed a GPS jamming device in his vehicle so his company couldn't track his movements. Unfortunately, his work brought him near Newark Liberty International Airport in New Jersey and interfered with GPS reception for the airport's air traffic control system, costing the driver $32K in fines and his job. While no one was hurt, this incident highlights how one irresponsible actor could, with a $100 device, create chaos at one of America's major international travel hubs. Imagine what malicious actors, hostile countries, or terrorist agents could do in such a GPS-dependent world.

That's why CSAIL Alliances Startup Connect Plus Member Skyline Nav AI has created a GPS-independent navigation system called Pathfinder™. By combining onboard sensors and computer vision software, Skyline Nav AI aims to make navigation more reliable, robust, and secure for both military applications and commercial markets.

ABOUT THE COMPANY: FROM ORDERS TO INDUSTRY AWARDS

Five years ago during the COVID-19 pandemic, CEO of Skyline Nav AI and US Army Captain (Massachusetts National Guard) Kanwar Singh received a call from the Pentagon. It was a Lieutenant Colonel requesting Singh to investigate creating a navigation system that didn't depend on GPS, which was becoming increasingly necessary for security purposes and military operations. Excited by the idea, Singh dove into the task, collaborating with scientists at the Army Research Lab (ARL). He says, "historically, the U.S. Federal Government has spent a lot of money doing basic R&D, but many of these investments never leave the lab." Determined to bring what he saw as an important and necessary innovation to those who could apply it, Singh connected with Dr. Rajeev Surati (MIT class of 1999), licensed the technology from the ARL, and spun out the company.

The first challenge Skyline Nav AI wanted to tackle was ground navigation, a personal frustration for both Singh and Dr. Surati. "One of the problems he and I had in common was getting lost in downtown Boston or in the tunnels when you miss an exit. It's just not a great experience driving in Boston when you're relying on satellites for positioning and navigation." Pathfinder Land compares pre-downloaded satellite imagery of the landscape with camera data from the car's onboard sensors, matching the datasets for real-time location positioning. When there's a gap in the visual data—for example, in a tunnel—the system uses Inertial Measurement Units (IMU) as a secondary source to keep track of distance, velocity, and direction. Combining these two approaches offers a full navigation system that can be done with no cellular or GPS connectivity, can't be hacked or jammed, and is 99.98% accurate.

Pathfinder on Land: Drove 17 miles without GPS in Greater Boston

Skyline Nav AI has also launched an aerial product called Pathfinder Air, which applies the same methodology but with 2D data from the sky. "The camera on the aircraft takes in information that's coming from below—homes, buildings, roads, stadiums, parks, construction sites—and then we compare that with pre-downloaded satellite datasets to do the matching."

This system offers 99.9% accuracy as compared to a typical GPS system. Unlike competitor technologies which rely on cloud computing, Singh says, "our technology is lighter weight, where you don't need that much compute, and can run on small edge devices like drones and aircraft. We can also work with many different camera types (visible light/RGB, EO-IR, thermal, grayscale, etc.) that are looking below or straight ahead."

Pathfinder in Air: We flew 6 miles without GPS in Greater Boston.

Skyline Nav AI is actively working with both military and industry groups to bring their technology to those who need it, and they're thrilled by how much their efforts have been recognized. In May of 2025, they were awarded $1.25M to integrate Pathfinder into various Air Force platforms, won the 2023 NASA Entrepreneurs Challenge and continue to be funded by NASA, won the 2025 Best Startup Award by Inside Unmanned Systems, won the top startup award at 2024 Move America, and are currently collaborating with several aerospace and vehicle companies to incorporate their software, all with no VC money. More recently, they also got third place in Isuzu's Global AI Innovation Challenge. Among their strategic partnerships is a collaboration with Kearfott Corporation, a renowned leader in Guidance, Navigation, and Control Systems, with whom they plan to launch new products in the fall. Singh has ambitious plans for the company, explaining, "our vision is that when you buy a passenger car or a drone or fly on an aircraft in the next two years, our technology will be integrated. We've already powered 17 miles of GPS-free driving through Boston and flown 100+ miles without GPS in complex airspace. With proven accuracy down to 46 centimeters, Pathfinder is capable of delivering the reliability and precision that the industry demands."

While deep tech can be a challenging and slow-moving area, Singh says that he's lucky to be working with such a creative and mission-driven team and believes their company is an example of "American ingenuity in action." Singh further believes that the "future of movement isn't just about satellites—it's about intelligence at the edge. By combining computer vision, AI, and precomputed satellite data, Pathfinder enables true autonomy for vehicles and machines, even in the most challenging environments. This is the foundation for the next generation of smart mobility and logistics."

CONNECTING WITH CSAIL ALLIANCES: THE MIT ECOSYSTEM AND IN-PERSON EVENTS

While Singh didn't go to MIT himself, he recognizes that "MIT has an incredible entrepreneurial ecosystem." In 2021, Skyline Nav AI won a Small Business Technology Transfer Research (STTR) Award from the federal government with MIT as a subcontractor on the award. This not only helped them think about dual use ecosystems and commercializing their technology but also plugged them into the MIT community. "We went through the MIT I-Corps program and then we did the NSF I-Corps Nationals as an MIT-sponsored team. We have been working with the Venture Mentor Service, the Industrial Liaison Program, and the Startup Exchange, and that's how we heard about CSAIL Alliances."

The biggest CSAIL Alliances benefit Skyline Nav AI has taken advantage of so far was attending the 2025 CSAIL Alliances Annual Meeting, a three-day, member-only event which brings together companies, researchers, students, and startups shaping the future of computing technology. Singh emphasizes how important it was to connect with other CSAIL Alliances members and researchers in person as it led to deeper conversations and more productive connections than online-only interactions.

"This is how business gets done. This is how deals happen. We are just very social creatures as human beings, and you can't replace the in-person aspect." Beyond that, Singh found many of the talks and presentations helpful for the company's strategy, especially CSAIL Director Professor Daniela Rus's talk on lightweight AI for edge robotics. "This talk deeply resonated with us, because at Skyline Nav AI we share this vision—building GPS-independent edge navigation using computer vision. Her work underscores the future of resilient, on-device autonomy for robots, drones, and humanoids." After the meeting, Singh is now following up on several collaboration opportunities, adding, "I'm always happy to talk to anyone in the MIT ecosystem."

Skyline Nav AI has also hired several CSAIL students through Alliances by working with Senior Client Relations Coordinator Christiana Kalfas—who he describes as "fabulous"—to post jobs and internships on the CSAIL Alliances website. "It's one way to give back to the MIT community, so I certainly want to continue to hire the incredible talent that comes from MIT."

NEXT STEPS: CONNECTING WITH COMPANIES & PREVENTING DISASTER

According to a 2019 study, large-scale GPS outage would cost the US economy $45B in economic losses in the first 30 days ($57B in 2025 dollars). Singh says, "As a society, we're underprepared for a large-scale GPS outage. Skyline Nav AI's mission is to ensure that when—not if—GPS goes down, our economy, our supply chains, and our critical infrastructure keep moving. That's the responsibility we carry, and that's what excites us every day."

This concern is not just theoretical. A December 2024 plane crash in Azerbaijan that killed 38 passengers was partly caused by a GPS outage, and many flights today are rerouted due to military activity that could cause dangerous GPS interference. "There are 7 billion people around the world who are reliant on GPS, which is a free service that America provides. But there are so many vulnerabilities in GPS, and we really need to start thinking about GPS independence. Every modern vehicle, drone, and logistics operation is built on the assumption that GPS will always be there. But as we've seen from recent incidents, GPS outages are a growing, global risk that threatens not just safety, but the continuity of commerce itself."

Motivated to get their technology utilized in as many areas as possible, Skyline Nav AI is excited to connect with more companies, researchers, and explore opportunities to work together. "For mobility and logistics leaders, resilience isn't a luxury—it's a necessity. Pathfinder delivers absolute, real-time positioning where GPS fails, ensuring your operations never stop, your assets are never lost, and your customers are never left waiting. In a world where every minute of downtime can mean millions in losses, that's a game-changer." Singh emphasizes that Pathfinder is lightweight, scaleable, and hardware-agnostic, making it easy to retrofit into existing fleets of cars, trucks, drones, or aircraft without the need for expensive new hardware or cloud connectivity.

The Skyline Nav AI team will continue to make key connections and show up at opportunities like those provided by CSAIL Alliances, "not just because it's more success for our company but because it will keep our economy more resilient and ensure that people can continue to do their mission and jobs even when they lose GPS, because that's going to happen."