

One ASU researcher's fix for freight's costliest miles

Industrial engineer Lacy Greening earns recognition for her work developing agentic artificial intelligence systems to improve freight logistics

By Kelly deVos, ASU News
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America's freight system is a miracle of modern logistics — until it isn't.

One snowstorm, one labor shortage, one delayed truck outside a major hub, and the whole process starts to wobble. Packages miss delivery windows. Shelves sit empty. Costs spike.

What's exposed in those moments isn't bad luck. It's a system that operates like the world is predictable. In reality, freight moves through chaos.

That's the problem [Lacy Greening](#) wants to solve.

Greening is an assistant professor of industrial engineering in the [School of Computing and Augmented Intelligence](#), part of the [Ira A. Fulton Schools of Engineering](#) at Arizona State University. She was recently named one of 15 semifinalists in the U.S. [Department of Transportation's Advanced Research Projects Agency – Infrastructure](#), or ARPA-I, [Innovation Challenge](#).

Chosen from 448 submissions nationwide, the recognition places her in a small, highly competitive cohort invited to pitch high-risk, high-reward ideas that could reshape how America's infrastructure works.

Stuck in the middle mile

Her idea starts with a simple question: What if the U.S. freight system could become smarter and more resilient through networks that learn, coordinate and adapt in real time?

Right now, freight logistics don't work that way. Planning systems are fractured. When something goes wrong, people scramble to stitch those systems together manually.

"Today, everything is planned kind of sequentially," Greening says. "We do route planning, we do dock scheduling, we do sortation planning — all separately. And if there's a delay in one place, it takes manual intervention to fix everything downstream."

Her proposed solution uses agentic artificial intelligence, or AI. Instead of a single, massive optimization model trying to solve problems for the entire freight network at once, Greening envisions many smaller AI agents that reason locally but coordinate globally to connect those isolated planning systems.

In practice, that means each part of the freight network can adjust in real time and communicate those changes to the rest of the system, without waiting for a human to step in.

"You can't solve the whole problem at once. It's way too big," Greening says. "Right now, we have dedicated models. The problem is they don't talk to each other. We want them to communicate without that manual handoff."

The work is part of a broader collaboration with [Reem Khir](#), an assistant professor at Purdue University. The team is zeroing in on the most failure-prone and expensive part of the freight pipeline: the middle mile.

If the first mile moves goods from factories and ports into a company's network, and the last mile delivers packages to front doors, the middle mile is everything in between. It's the web of transfers between warehouses, fulfillment centers and regional hubs.

"Middle mile is typically the most complex part of the system," Greening says. "There's so much consolidation that has to happen, and that's where a lot of the costs are tied up."

It's also where today's tools struggle most. Middle-mile decisions are still largely reactive. When disruptions hit, manual responses can take 30 to 60 minutes or longer to roll out across a network. By then, delays have already cascaded.

Cutting the cost of disruption

The ARPA-I Innovation Challenge exists precisely to upend the status quo. The challenge calls for bold, transformative ideas that can improve safety, reliability and cost efficiency across U.S. infrastructure.

Greening's proposal does that with a three-tier, agentic AI framework. At the bottom layer, AI agents continuously ingest data, such as weather forecasts, traffic conditions, equipment health and workforce availability. In the middle layer, planning agents use optimization and machine

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learning to reroute trucks, reschedule docks and rebalance resources as conditions change. At the top, humans remain firmly in control, overseeing decisions, validating outcomes and stepping in when stakes are high.

Think of it as a freight network with reflexes that can respond before small problems become big ones.

“If there’s a massive snowstorm coming that’s going to delay a bunch of loads into one location, you might want to reroute trucks in anticipation of that,” Greening says. “Our proposal seeks to prevent the disruption instead of just reacting to it.”

Preventing disruption isn’t just about speed. It’s about cost. When shipments fall behind, companies resort to expensive fixes — air freight, team drivers and overtime labor.

“Delays cause problems,” Greening says. “And problems increase costs.”

Being named an ARPA-I semifinalist pushes the project into its next, more public phase. As part of stage 1, Greening advanced to a U.S. Department of Transportation Innovation Workshop in Washington, D.C., where she pitched the concept and received feedback from government and industry experts.

What comes next could be substantial. Winners from Stage 1 will submit full research and development proposals for stage 2, competing for one of five final awards.

A career accelerating fast

For Greening, who joined the Fulton Schools faculty in 2024, the recognition arrives early in her academic career, but it’s built on deep industry experience. She earned her doctoral degree from the Georgia Institute of Technology, where she was a Dwight D. Eisenhower Transportation Fellow, collaborated with The Home Depot, and worked as a research scientist intern with [Amazon’s middle mile planning, research and optimization sciences group](#).

“Industrial engineers get to solve problems and optimize processes within essentially every industry,” she says. “Supply chains stood out because the problems are real, and they affect people every day.”

[Ross Maciejewski](#), director of the School of Computing and Augmented Intelligence, says Greening’s selection highlights both the national significance of her work and the growing role of AI-driven decision-making in the transportation sector.

“Lacy’s research reflects the kind of systems-level thinking that programs like ARPA-I are designed to surface,” Maciejewski says. “She’s not just applying AI to transportation problems, she’s rethinking how complex infrastructure systems can sense disruption, adapt in real time and ultimately perform better at scale.”

At a time when supply chains are stretched thin and disruptions are no longer rare events, Greening’s work asks a sharp question: What if freight systems didn’t just endure chaos but learned from it?

The answer may help determine how resilient America's infrastructure can be.

This story originally appeared on [ASU News](#).

Main image



Lacy Greening, an assistant professor of industrial engineering in the School of Computing and Augmented Intelligence, part of the Ira A. Fulton Schools of Engineering at Arizona State University, is one of 15 semifinalists in the U.S. Department of Transportation's Innovation Challenge for her work developing agentic artificial intelligence systems to improve freight logistics. Photo by Erika Gronek/ASU

Text image(s)

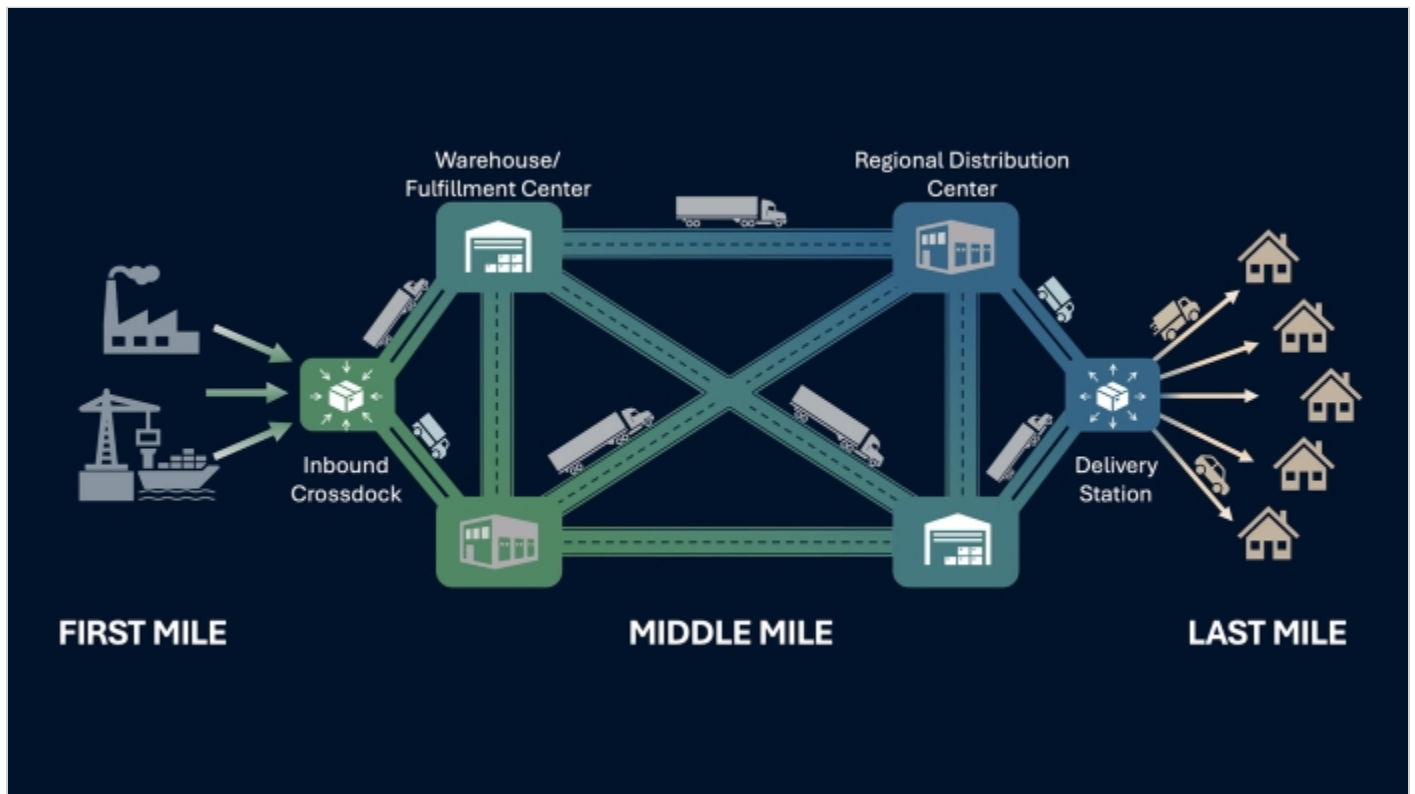


Diagram of a modern logistics network showing the first mile, middle mile and last mile of delivery. Goods move from manufacturers and ports through warehouses and regional distribution centers, then travel through interconnected middle-mile routes before reaching delivery stations and customers' homes. Graphic courtesy of Lacy Greening