

Amazon

Today’s warehouse environment is changing. Booming e-commerce order fulfillment demands, shifting customer preferences and shipping expectations are driving an evolution in warehouse and material handling technology. Forklifts, or Powered Industrial Trucks, remain an essential part of warehouse operations. They are reliant on operator competency and behavior; however, the technology built into them has not evolved at the same pace as other warehouse technology advancements.

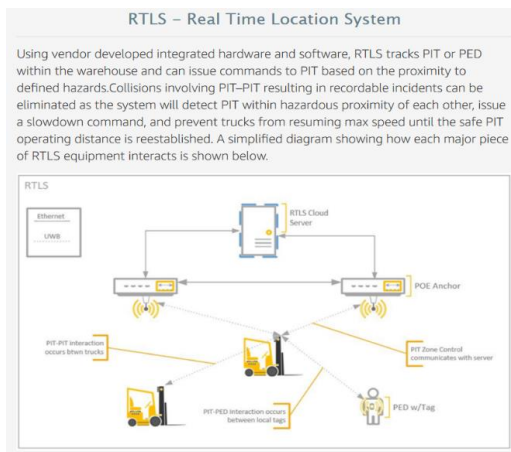
According to the Bureau of Labor Statistics, between 2011 to 2017, 614 workers in the U.S. lost their lives in forklift incidents - meaning one person was killed every three days. NSC Injury Facts reported forklifts were the source of 79 deaths and 8,140 non-fatal injuries involving days away from work in 2019. The non-fatal injury rate remained stagnant at 0.8 for the past three years. The most common cause of PIT incidents is driver error resulting in people being caught between or struck by a PIT.

Since 2019, Amazon’s global PIT fleet has grown by 33%. During this same time frame PIT-related serious injury rate decreased by 59% and recordable incident rate decreased by 10%. These drops in injury rates resulted from the implementation of PIT telemetry, enhanced training and other engineering risk controls. While Amazon is pleased with this result, the goal is to impact the broader industry and eliminate PIT-related severe injuries through next-generation technology that removes sole reliance on an operator’s response and reduces the risk of human factors in PIT operations.

Universal PIT safety has not materially advanced over the last 20 years. In 2019, Amazon challenged itself

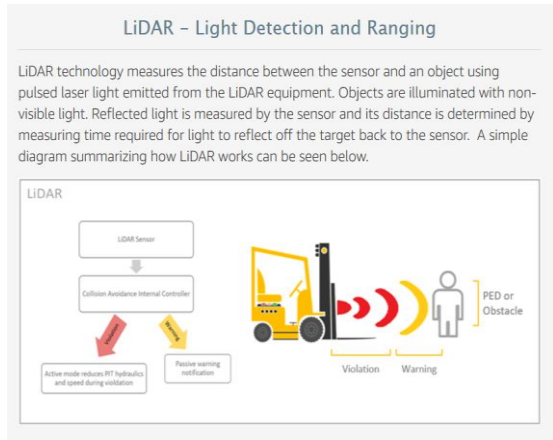
to leverage the company’s innovative technology-driven culture to eliminate PIT-related severe injuries across the industry.

Amazon engaged with their five major PIT Original Equipment Manufacturers to dive deep into the problem, and pushed them to work to collaboratively develop and integrate technology to improve PIT safety. Amazon engineers and scientists, along with PIT manufacturers, assessed various technology concepts that lead to conceptualizing the Collision Avoidance Technology. CAT combines Light Detection and Ranging and Real-Time Location System. While this type of technology is used in other applications (e.g. motor vehicles), no PIT Original



Equipment Manufacturer has integrated it within a forklift. This will be the first industry-wide PIT solution with integrated semi-automatic controls, aimed to eliminate many of the human factors that lead to PIT operator error and related incidents.

Light Detection and Ranging technology measures the distance between a sensor and an object using non-

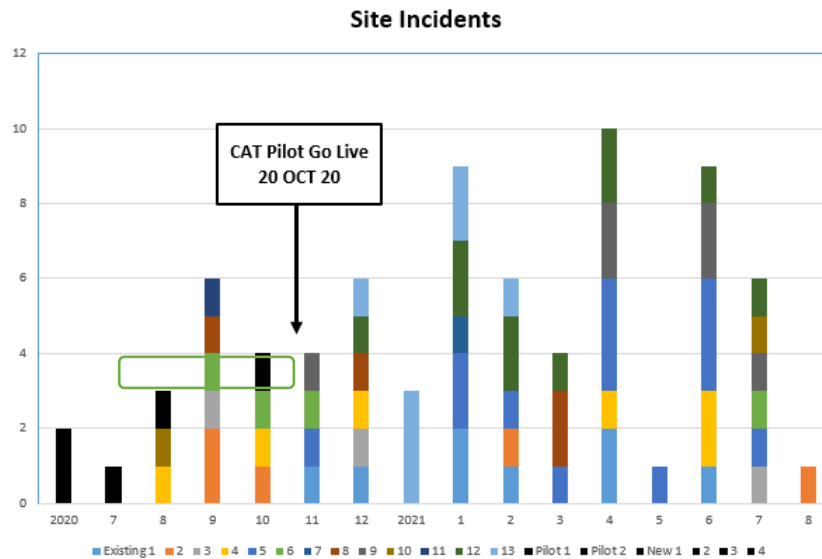


visible, pulsed laser light. When installed on PIT equipment, it automatically reduces PIT speed when an object is detected within the specified field of vision. In parallel, Real Time Location System uses ultra-wide band signals to track PIT or pedestrians by communicating with anchors installed throughout the warehouse and tags located on PIT or pedestrians. The system issues automated commands to PIT based on the proximity to defined hazards. The Fully implemented system considers three scenarios: PIT to anchor, PIT to PIT, and PIT to pedestrian. Using localization data, CAT identifies conditions that could lead to collisions, equipment and product damage, or damage to life and limb.

This same technology can also identify non-threatening proximity detections and prevent unnecessary loss of productivity through excessive speed reductions.

CAT is currently launched at six sites throughout Amazon, with four more sites in the process of being commissioned. Two sites have been operating for a year. Amazon has experienced a 95% reduction in recordable incidents in 2020 and 100% reduction year-to-date. They expect 100% reduction in recordable incidents at the 10 new sites launched in 2021.

In 2022, Amazon plans to launch 65 CAT sites, and plans to have 100% CAT compliance across the worldwide network by 2025. This will include over 40,000 PITs and approximately 700 sites. This will be a four-year \$300M project.



The chart above demonstrates the 100% reduction of SIs in 2021.

Fast Facts

1. Hardware (truck) installation
PIT will arrive with RTLS and LiDAR pre-installed for Greenfield sites
2. Infrastructure installation
Anchor and wire installation during building creation and will be completed during Wi-Fi cable routing
3. RTLS Zone Creation
A critical aspect of RTLS deployment is the zone creation throughout the facility, which will automatically influence the truck's speed based on zone type.
4. Pedestrian Badges
The pedestrian badges will be distributed and collected at security check-in/out, to ensure all visitors receive a badge and to ensure all badges are accounted for and cleaned between users. A pedestrian tag process will be implemented in partnership with operations at each site.
5. Training
The PIT Safety core team will work directly with the Operational Learning team to develop Collision Avoidance specific training that leverages the existing PIT training.

A special thanks to the Amazon Engineers that collaborated from a cross functional perspective of safety, hardware engineering, operations. Amazon appreciates the vendors who continue to work with Amazon to raise the safety and compliance bar to protect employees and help the company realize its vision to become Earth's Safest Place to Work.