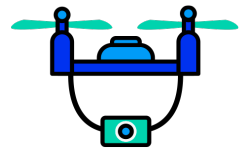


SMART

GRANTS PROGRAM



Rail Safety, efficiency, and climate resilience by using drones and sensors to monitor and analyze railroad infrastructure threatened by ground water variability

Massachusetts Department of Transportation

PROJECT PARTNERS

MassDOT Aeronautics Division
University of Massachusetts Boston



PROJECT CHALLENGE

The Rail & Transit and Aeronautics divisions of the Massachusetts Department of Transportation will improve rail safety, prevent disruptions, and avoid costly repairs by using drones with sensors and remote sensing tools installed in embankments and water bodies to reduce the risk of rail embankment collapse during drought due to reduction of hydrostatic water pressure near ponds or rivers on the Cape Cod area's Cape Main Line. We plan to analyze and equip these embankments and water bodies with sensors to reduce the risk of human and financial fallout from a rail collapse. By doing this project, we are strengthening the safety and resiliency of critical rail infrastructure threatened by sudden changes in water pressure due to flash droughts induced by climate change.

IMPACT

The project will be deployed along the Cape Main Line in Cape Cod, Massachusetts, benefiting freight railroad operators, customers, and seasonal passengers by enhancing rail safety and efficiency. It targets areas near water bodies where embankments are vulnerable due to hydrologic variability, aiming to mitigate rail infrastructure failure risks associated with flash droughts and sudden changes in groundwater levels. By utilizing drones and sensors for early detection and monitoring, the initiative will bolster community safety, diminish the risk of train derailments, and minimize environmental impacts, ensuring more reliable and secure rail operations.

CURRENT STATE OF THE ISSUE

The MassDOT project addresses climate-induced flash drought impacts on rail safety, spotlighting recent Massachusetts and Maine embankment failures. Using drones with lidar, the project aims to characterize local drought effects, analyze embankment stability, and deploy early warning systems to prevent future derailments.

POLICY QUESTIONS

1) How effectively do drones and sensors reduce rail failures from flash droughts, and how can findings improve safety regulations? 2) What best practices enhance rail safety and resilience through community and stakeholder engagement? 3) Can monitoring technologies and early warning systems shape policies against climate change impacts on infrastructure?

STAGE 1 OUTCOMES

1. Enhanced rail safety through early detection of infrastructure vulnerabilities, reducing the risk of derailments and accidents. 2. Improved community engagement and stakeholder collaboration in rail safety initiatives, leading to more resilient infrastructure. 3. Informed and updated transportation policies and guidelines reflecting the integration of advanced monitoring technologies.

STAGE 2 VISION

Our vision for expanding the project includes broader deployment across Massachusetts' rail systems, utilizing advanced sensors, drone technology, and AI for in-depth infrastructure monitoring. This expansion is designed to mitigate not only flash drought impacts but also other climate-related threats such as sea level rise and heavy rainstorms, alongside addressing security concerns like trespassing. We anticipate this will lead to significant reductions in service disruptions and enhanced public safety, while establishing a nationwide model for climate-adaptive infrastructure.