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RESEARCH BRIEF

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Advanced Air Mobility to
Enhance Rural Freight Logistics



the **ISSUE**

Heavy freight traffic accelerates pavement deterioration, bridge fatigue, congestion, and safety risks, particularly in rural and regional corridors. This research evaluates how advanced air mobility (AAM), an emerging transportation system that uses highly automated, electric vertical takeoff and landing (eVTOL) aircraft, can selectively shift suitable freight from roads to air, preserving ground transportation infrastructure while improving reliability and system efficiency.

the **RESEARCH**

This research evaluated the feasibility of using AAM to enhance rural and regional freight logistics while preserving ground transportation infrastructure. The study applied an integrated, multi-method approach combining technology assessment, market analysis, infrastructure evaluation, and regulatory readiness analysis. The technology assessment examined aircraft performance constraints, propulsion efficiency, energy density limitations, and innovation trends in batteries and hydrogen systems using performance modeling, bibliometric analysis, and systematic patent review. The market analysis applied geographic information systems, freight flow datasets, clustering methods, and hybrid data mining to identify concentrated demand for hazardous materials, pharmaceuticals, and other high-value freight suitable for aerial substitution. Infrastructure evaluation assessed the potential to reuse existing airports, hospital aviation assets, and intermodal nodes to design scalable middle-mile and last-mile AAM networks. Regulatory readiness was analyzed using machine learning models to evaluate governance and institutional factors associated with AAM adoption. By synthesizing results

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Project Title

Advanced Air Mobility
to Enhance Rural Freight
Logistics

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the **RESEARCH** cont.

across these components, the study identified where technical feasibility, concentrated freight demand, infrastructure availability, and regulatory conditions align to enable targeted, high-impact freight diversion from road to air.

the **FINDINGS**

The research found that AAM can preserve ground transportation infrastructure when deployed selectively on routes that meet four conditions: realistic energy limits, concentrated freight demand, existing aviation nodes, and supportive regulatory environments. Current aircraft performance supports short- to medium-range missions, particularly for high-value, time-sensitive, or hazardous freight. Demand for these commodities concentrate geographically, enabling repeatable operations that can displace truck traffic rather than supplement it. Existing airports, hospital-adjacent facilities, and regional airfields can support early deployment with limited new construction. Regulatory readiness and governance capacity strongly influence where AAM can scale. Overall, the findings show that targeted AAM freight networks can reduce heavy truck exposure on vulnerable corridors, improve reliability, and extend the service life of pavements and bridges.

the **IMPACT**

This research provides a practical framework for selectively diverting freight from roads to air, targeting corridors where heavy truck exposure accelerates pavement and bridge deterioration. By shifting even a modest share (e.g., 5%–15%) of high-value or hazardous freight on concentrated routes, agencies can reduce cumulative axle loads, lower maintenance frequency, and improve safety outcomes. The approach also enhances delivery reliability for time-critical goods such as pharmaceuticals. Implemented strategically, AAM freight networks can extend infrastructure service life, reduce congestion at key gateways, and improve rural access without requiring large-scale new construction.

For more information on this project, download the Main report at <https://www.ugpti.org/resources/reports/details.php?id=1280>

For more information or additional copies, visit the Web site at www.ctips.org, call (701) 231-7767 or write to Center for Transformative Infrastructure Preservation and Sustainability, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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