RESEARCH
PROJECT CAPSULE
January 2024
24-3SS
TECHNOLOGY TRANSFER PROGRAM

Evaluating Practical Applications of Unmanned Aerial Vehicles for Traffic Incident Response and Management

JUST THE FACTS:

Start Date:
January 1, 2024

Duration:
24 months

End Date:
December 31, 2025

Funding:
TT-Fed/TT-Reg-5

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Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used / Implementation Potential

PROBLEM

The use of unmanned aerial vehicles (UAVs), also known as drones, has seen an explosive increase in all sectors over the last two decades. UAVs have found use in the military, law enforcement, agriculture, real estate, transportation, emergency services, public services, commercial enterprises, and many other sectors. In the field of transportation, UAVs are used in infrastructure monitoring and assessment, traffic incident response, detour, and congestion monitoring, among others. The use of UAVs in traffic incident management (TIM) shows a lot of promise. UAV applications in TIM is related to the following purposes, including but not limited to, incident verification, situational awareness, detour route monitoring, queue detection and monitoring, secondary crash detection, and response vehicle routing (FHWA). The advantages of UAV use for traffic incident response are numerous, including increased situational awareness, especially in locations without CCTV cameras, better coverage and increased mobility in comparison to CCTVs, and being substantially more operationally affordable when compared to fully manned aircrafts (FHWA). The other benefits of UAV use in TIM are efficient use of resources due to better situational awareness leading to faster incident clearance times, decreased risk of secondary crashes, and a reduction in congestion (Carrick & Burgess, 2021; Stevens & Blackstock, 2017). Also, UAVs can operate within corridors where permanent infrastructure cannot be installed, which could lead to faster responses to traffic incidents in rural areas where there may be limited communication (Carrick & Burgess, 2021).

Figure 1. UAV picture from the scene of a traffic incident (FHWA, 2021)

Figure 2. Traffic incident response monitoring with a UAV (Carrick & Burgess, 2021)

OBJECTIVE

The objectives of this research project are:

- Assess the feasibility of UAV use in Louisiana's traffic incident management (TIM) and monitoring
- Document issues and challenges in drone use for incident response
- Develop an information guide on UAV use for TIM

METHODOLOGY

A literature review will be conducted to understand the federal and state regulatory landscape, operational requirements, and pilot licensing requirement. This task is necessary to align UAV operating procedures to be consistent with federal and state statutes.

Next, an identification and engagement of stakeholders will be undertaken to seek their input and support. Potential stakeholders for the research include staff from the Department of Transportation and Development (DOTD) ITS and Location and Survey offices, Motorists Assistance Patrol (MAP), and law enforcement.

As part of the task for scenario selection and pilot test planning, the research team will identify user cases for different test scenarios. Test flights will then be planned based on these test scenarios to test the full capabilities and functionalities of UAVs in terms of flight and control, data collection, and transmission of live video streams to a TMC. Also, specific scenarios under which tethered and untethered UAVs are most applicable will be identified. Next, pilot testing will be undertaken for the scenarios selected. The purpose of the testing is to assess how UAVs may be used in different aspects of traffic incident response. Important issues to be considered during testing include UAV setup location, optimum operational heights, bandwidth for transmission of video and data, video resolution, and operational safety. Other aspects of the tests to be considered are mobility with required payload of cameras and sensors, seamless sharing of real-time enhanced video data to a TMC, and guided data collection.

During the pilot tests, limitations and challenges of UAV use for TIM will be identified and documented. Possible limitations are the effects of federal and state laws, FAA guidelines, geography, crash site accessibility, line of sight, and traffic conditions. After the tests, the research team will develop an informational guide that documents federal and state laws regarding UAV use. The guide will also include procedures to acquire operator qualifications, pre-approval processes, and waivers. Importantly, the guide will document flight planning processes, defined role of operators, pre- and post-flight procedures, and operating rules among others. The guide will also incorporate UAV deployment and operation as part of the current MAP procedures.

The final task will be to conduct a benefit cost analysis of UAV use in TIM. Costs and benefits related to UAV use for TIM will be identified, quantified, and monetized through standard analytical procedures and available tools. If the analysis shows that there is an economic benefit of UAV use for TIM, this finding may be brought to the attention and awareness of TIM stakeholders, policy makers, and the general public to engender support for UAV use in TIM and other transportation engineering operations.

IMPLEMENTATION POTENTIAL

The proposed research approach is integrating a UAV system into TIM operations, which will allow for better coordination and communications during incident response. A deployment of this system could be instrumental in traffic incident response especially in rural locations and places not covered by CCTV cameras. Overall, a statewide deployment of UAV use in TIM would improve the efficient operations of incident response in the state.