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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION
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Research Results

Incorporating New UAS Technology into the Caltrans UAS Safety Management System

Seeks to update the current California Department of Transportation (Caltrans) Unmanned Aircraft Systems (UAS) Safety Management System (USMS) with Standard Operating Procedures (SOPs), training requirements/curriculum and policy recommendations to address the latest innovative UAS technology.

Modal

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WHAT WAS THE NEED?

The need arose from the limitations of traditional Unmanned Aircraft Systems (UAS) used by Caltrans maintenance field crews. Typical UAS offered only short flight durations and were restricted by weather conditions, such as cloud cover. There was a requirement to enhance operational capabilities by incorporating new UAS models and operations-including tethered, autonomous, Beyond Visual Line of Site (BVLOS), and fixed wing platforms. Tethered UAS provided extended flight times and continuous transmission from emergency or incident sites to Emergency Operations Centers and Traffic Management Centers (TMCs), even in challenging weather. Autonomous, BVLOS, and corridor mapping UAS enabled broader, higher, and more frequent operations, expanding use cases for surveying and construction. These advancements were needed to improve safety, efficiency, and accuracy beyond what traditional UAS could deliver.

WHAT WAS OUR GOAL?

The goal was to update the current Caltrans Unmanned Aircraft Systems Safety Management System (USMS) by developing Standard Operating Procedures (SOPs), establishing training requirements and curriculum, and making policy recommendations. This was intended to ensure Caltrans could effectively address and integrate the latest innovative UAS technologies into its operations.

Caltrans

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WHAT DID WE DO?

The research project was designed to update the current Caltrans Unmanned Aircraft Systems Safety Management System (USMS). The research team evaluated new UAS technologies to support expanded operations, such as beyond visual line of sight, docking systems, tethered UAS, advanced autonomy, vertical takeoff and landing (VTOL) UAS, fixed-wing UAS, and improved connectivity and management.

Key deliverables included a gap analysis report, recommendations for revised policies and procedures, and an updated training curriculum. Throughout the project, researchers implemented recommendations to ensure safety procedures were addressed as new findings emerged. By the end of the research, the new insights and practices were merged into the existing USMS, with any outstanding items scheduled for implementation within one year after project completion.

The project involved investigating novel technology operational practices, training requirements, and management oversight. Researchers developed training curriculum and policy recommendations, employing a systematic approach to evaluate operational management, supplementary equipment deployment, logistics, crew coordination, and network/cellular access. This process resulted in a Caltrans USMS Gap Analysis report, followed by curriculum development and the creation of a recommendation report.

WHAT WAS THE OUTCOME?

The research established that Caltrans had built a strong foundation in policy and safety for its Unmanned Aircraft Systems (UAS) program, but several organizational and operational gaps had constrained the maturity and integration of its Safety Management System (SMS). Flight and hazard records were found to be inconsistently completed, which reduced visibility into operational risk trends, and risk assessments and corrective actions were not consistently linked, weakening continuous improvement efforts. Data was stored in flat spreadsheets, preventing traceability and long-term performance analysis. Field operators reported redundant paperwork, unclear form sequencing, and limited tool integration, while training and advancement opportunities were uneven, especially for newer or less frequent pilots. The introduction of emerging UAS platforms shifted workload from manual control to supervision and monitoring, increasing demands on operators. The research demonstrated that combining SMS data with information from automated systems was necessary to enable better safety predictions, and that feedback mechanisms should connect field operations to policy and training development. As a result, the study recommended addressing these gaps by enhancing data systems, improving training, and strengthening oversight of automation to ensure safety and regulatory compliance. These actions were identified as essential for Caltrans to achieve organizational-level safety assurance and readiness for future operations.

WHAT IS THE BENEFIT?

The adoption of Unmanned Aircraft Systems (UAS) improves safety for Caltrans employees, contractors, and the public. It increases operational efficiency and produces cost savings. This research shows that Caltrans employees can safely use new UAS technology for construction, surveying, traffic operations, and emergency management.

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