SCAN TEAM REPORT

NCHRP Project 20-68A, Scan 17-01

SUCCESSFUL APPROACHES FOR THE USE OF UNMANNED AERIAL SYSTEM BY SURFACE TRANSPORTATION AGENCIES

Supported by the
National Cooperative Highway Research Program

Executive Summary

Overview

The past decade has seen ever-increasing attention and resources dedicated to the application and operation of unmanned aircraft systems (UASs). Beginning with issuance of special airworthiness certificates in the experimental category for unmanned aircraft in 2007, up to the Federal Aviation Administration's (FAA's) Modernization and Reform Act of 2012 and creation of Title 14 Code of Federal Regulations (CFR) §107 and §101, the complexity and breadth of applications for UAS technology have flourished.

Recognizing the interest and potential benefits to the surface transportation community the National Cooperative Highway Research Program (NCHRP) commissioned Scan 17-01 to accelerate beneficial innovation by facilitating information sharing and technology exchange among the states and other transportation agencies. Results from a desk scan, amplifying questions, and a peer exchange workshop produced conclusions and recommendations in seven topic areas for transportation agencies to consider when getting started using a UAS.

Key Findings and Observations

Executive Support

Top-down investment and support from executives emerged as one of the first elements transportation agencies interested in implementing a UAS need.

Findings and Conclusions

Successful programs:

- Have discerned the application and operation of a UAS based on one or more of the following:
  - Increased safety or reduced liability
  - Increased efficiency and productivity, or reduced impact on the public
  - Cost savings
  - Environmental protection
  - Higher quality end products
- Do not have to be high cost
- Recognize the importance of planning both the initial funding (i.e., for purchase) and continued use of UAS equipment (i.e., operations and maintenance)
- Agree that a UAS saves resources and increases efficiency. However, improvements could be made to support more comprehensive cost-benefit comparisons to traditional methods
- Emphasize the benefits of a UAS but understand negative connotations related to the technology

Organizational Structure

A clear organizational structure within transportation agencies will provide the framework for long-term success.

Findings and Conclusions

Successful programs:

- Have a centralized authority and top-down support
- Leverage existing aviation experience in their state
- Utilize a variety of funding models but have a dedicated source
- Recognize that a relationship with and understanding of the Federal Aviation Administration is critical
- Dedicate personnel to understanding and keeping up with federal, state, and local regulations
- Transfer knowledge across departments and encourage transparency through relationships
- Increase efficiency through fleet management and resource sharing

Policy and Regulation

Knowledge of federal statutes and regulations related to unmanned aircraft is an essential starting point. In addition, each agency must establish policy for acceptable use and operational guidelines for a UAS.

Findings and Conclusions

Successful programs:

- Align their policies and procedures to be consistent with federal statutes and regulations
- Have expertise in UAS regulations and have the ability to keep up with changes
- Understand how to obtain airspace authorization and work with local airports
- Promote existing regulations within the state to prevent unneeded regulations on a state and/or local level
- Develop or adopt a policies and procedures manual for UAS operations

Safety and Risk Management

Safety culture and risk-management processes are critical business practices for UAS operations.

Findings and Conclusions

Successful programs:

- Have a system to manage safety, which include a emergency response plans (ERP) and safety policies
- Have proper personnel and equipment for each mission
- Have flight risk-assessment tools and risk-acceptance procedures

- Adopt and promote an aviation safety culture
- Ensure adequate insurance

Training and Crew Qualifications

Standardized practical training is needed to ensure safety and accurate data collection.

Findings and Conclusions

Successful programs:

- Understand that meeting Part 107 minimum requirements is not a guarantee of the UAS expertise needed for surface transportation UAS applications
- Establish and maintain initial and recurrent training needs for proficiency
- Tailor training needs to the varied applications of a UAS
- Identify expectations of UAS operations with management
- Use training to educate users on alternate methods of compliance for UAS operations, such as night operations, flight over people, or complex airspace

Public Relations

A thorough public relations plan, including elements such as community outreach and education, and a method for addressing public privacy concerns were prominent among invited states.

Findings and Conclusions

Successful programs:

- Have a plan that identifies and addresses target audiences, specifically:
  - Internal stakeholders (program, executive leadership, technical staff, stateemployees, and legislators)
  - External stakeholders (federal, state, local, university, vendors, the public, and airports)
- Identify existing regulations, rules, and policies and make positive use of social media, videos, and outreach to educate UAS users (both commercial user and hobbyists)
- Include the media in worksite setup, addressing privacy, safety, notice of operation, and on-site interaction during UAS flight.
- Include communication office in their ERP

Application and Operation

A comprehensive operational use plan emerged as essential for implementation of a UAS program.

Findings and Conclusions

Successful programs:

- Recognize that each state transportation agency is unique.
  - It is important to recognize that data needs vary and should be systems-requirements driven.

- Start small and grow with success
- Do not require a large investment to get started
- Justify UAS use with increased safety, reduced liability, greater cost savings, greater productivity, better end products, enhanced environmental protection, and reduced impact on the public
- Follow standard operating procedures
- Leverage the UAS across disciplines and share UAS assets throughout the state
- Leverage expertise in UAS operations
- Use post-processing software and hardware
- Have workflow processes for data collection, storage, usage, application development, and repurposed use of collected data

Recommendations

Considering the key findings above, the scan team settled on recommendations related to each of the seven topic areas. From executive support, the team encourages new programs to support initial plans by leveraging the successes of other state transportation agencies. Programs should plan to procure a system that is only as advanced as necessary for the operation. They should plan for a simple but impactful proof of concept, develop metrics by which executives can measure its success, and connect the metrics to a media plan.

In organizational structure, the scan team found that a centralized authority with top-down support, such as a UAS Steering Committee, was most effective. Such a committee can approve policies and procedures for implementing a UAS program and can build off the foundations set by scan team operations mentioned in Chapter 3. .

New programs are advised to designate a single point of contact for managing authorizations with the FAA and stay up to date with federal and state regulatory changes. To date, implementation of unmanned aircraft brings a complex aviation component to surface transportation; traditional pilots and aviation experience and expertise must be available for programs to succeed.

The policies and regulation of UASs continue to develop and evolve on a near monthly basis. As they develop or adopt UAS-specific policies, new programs are encouraged to consider:

- Who is allowed to operate the UAS and prohibit work use of personal model aircraft
- Normal and emergency procedures, checklists, and aircraft operational manuals
- Personnel requirements for UAS operators as well as procedures for securing and utilizing airspace authorization
- Standards by which vendors may be contracted and data products will be accepted

In the topic of safety and risk management, programs are again encouraged to utilize internal aviation expertise as they adapt risk management processes and cultivate a culture of safety around their unmanned programs. Specific recommendations included developing a system to manage safety within the agency; ensure that insurance policies provide proper coverage for internal and external operators; and assess and document, safety, risk, and safety culture within the agency.

While 14 CFR §107 allows for the operation of a small UAS (sUAS) in the national airspace, the scan team recommends utilizing the associated operator certification as a foundation to build upon. In the training and crew qualifications topic area, programs are encouraged to consider a tiered system for initial and recurrent operator training. Beyond the 14 CFR §107 Remote Pilot's Certificate with an sUAS rating, such a system may consider flight training with an unmanned training platform, solo flight training specific to the proposed sUAS, and mission-specific training.

Invited participants and scan team members recognized that public relations are of particular importance to conducting unmanned operations. Stakeholders internal and external to a program's agency should be identified and engaged through diverse media channels. Each program should develop a public relations plan and should include media relations personnel in UAS site setup. An ERP must be established prior to flight operations and provide protocols for contacting key personnel and distributing quick media responses in the event of an emergency.

Finally, in the application and operations topic area the scan team recommended that stage transportation agencies should document and share use cases. This will encourage the agencies to leverage the experience and expertise of those who are currently conducting unmanned operations. As use cases are considered, workflow processes must consider how data will be collected, stored, and used. Whatever data is necessary for the application should also determine the type of sensor to be used, which will in turn determine the platform, equipment, and software acquired.

Overall, the invited and host state transportation agencies have collectively developed significant use cases for sUASs, which supplement their surface transportation efforts. Future sUAS programs among state transportation agencies should consider further validation of these applications with rigorous cost-benefit analysis and investigate whether sUAS data can be suitable for meeting industry standards.

Additional Information

Appendices in this report provide the following additional information:

- Appendix A Scan Team Biographical Sketches
- Appendix B Scan Team Contact Information
- Appendix C Amplifying Questions
- Appendix D Workshop Agenda and Invited Participants
- Appendix E Certificates of Waiver or Authorization
- Appendix F Section 333 Exemptions
- Appendix G 14 CFR §107.200(s) Waivers
- Appendix H Sample UAS Policies and Procedures
- Appendix I AMA sUAS Flight Safety Guide
- Appendix J Sample Safety Culture Survey