Unmanned Aerial Systems (UAS)

ES 6

Photo: Courtesy of Edward McCormack, University of WA

Description: Unmanned aerial systems (UAS), sometimes called unmanned aerial vehicles (UAV) or drones, are aircrafts that are piloted by either a remote control or an onboard computer. UAS are typically used in situations where sending a piloted aircraft could be dangerous or expensive. UAS can be used for many transportation applications including: evaluating road conditions, monitoring traffic or parking lot use, mapping unpaved roads, or inspecting infrastructure (bridges, culverts, etc.). For example, a UAS may be used during a winter storm for an agency to determine when and where to plow or de-ice roadways. UAS can be used for numerous types of emergency services. For example, law enforcement, can use UAS for aerial surveillance, search and rescue to locate people or scout hard to reach areas; firefighters can use a UAS to detect wildfires; and emergency responders can use one to survey the scene of a crash. UAS could also deliver medical supplies or a telemedicine kit, which would offer the ability to communicate with medical personnel to people unable to access health facilities due to natural disasters or other reasons.

Please Note: Although UAS may be useful for many transportation applications, as of May 8, 2017 the purchase of such devices is currently not permissible for all FHWA programs (either as direct awards or by subcontract) until further determinations are made. Should you have any questions, please contact Aimee

Rural Transportation Critical Needs

- ☑ Crash Countermeasures
- ☑ Emergency Services
- ☑ Operations & Maintenance
- ☐ Rural Transit & Mobility
- ☐ Surface Transportation & Weather
- ☐ Tourism & Travel Information
- ☑ Traffic Management

Issues Addressed

- ☑ Emergency service notification time
- ☑ Emergency service response time
- ☑ Communications between multi-jurisdictional/multi-agency emergency service personnel

Strategies Achieved

- ☐ Road User
- ☑ Road
- ☐ Vehicle
- ☐ Safety Culture
- ☑ Engineering
- ☑ Emergency Response
- ☑ Enforcement
- ☑ Education

Applicability	Partnerships	Key Components
•In a rural area where response times are longer, a UAS could quickly access a crash scene to provide emergency responders with real time visuals of what to expect upon arrival. UAS are even more useful in situations where it would be dangerous to send in emergency responders. Furthermore, a UAS could provide people in rural or remote areas access to medicine in situations where the patient cannot access medical facilities, reducing the patient wait time for receiving care.	•Applications benefit from collaboration among numerous agencies, which may include: •Federal Aviation Administration (FAA) •Department of Homeland Security (DHS) •Departments of Transportation (local, state, federal) •Law Enforcement •Emergency Responders •Search and Rescue	•Training for UAS Operators •Aircraft •Remote Controller •Autopilot Software •Camera

Examples of Implementation

- **Lancashire Fire and Rescue**

Lancashire (United Kingdom) Fire and Rescue has used UAS to see the full extent of damage and hazards involved with a fire to keep firefighters safe. UAS have also been used during a flood to view the entire flooded area as well as to see if there was an immediate threat to life.

- **Healthcare Integrated Rescue Operations (HiRO)**

Dr. Subbarao and Guy Paul Cooper Jr. of Carey Medical College are working on a project, Healthcare Integrated Rescue Operations (HiRO). HiRO is a modified drone which can transport a telemedicine kit to deliver medical supplies and attention to people in areas where emergency responders cannot access, such as those trapped in a natural disaster area or an injured hiker in a remote location. The telemedicine kit includes a smartphone with video capability so that the injured individual can speak with medical personnel. HiRO is still in the testing phase.

- **Ambulance Drones**

The Ambulance Drone has been unveiled in the Netherlands. The Ambulance Drone transports a defibrillator and audio/visual instructions for cardiac emergencies. The Ambulance Drone can travel up to 60 mph, so it can quickly access a cardiac patient to increase the chance of patient survival.

- **Michigan Tech Research Institute (MTRI) UAS Study**

MTRI is currently researching the use of UAS with high-resolution aerial imagery capabilities for low cost ways to map and evaluate the condition of unpaved roads, evaluate culvert conditions, and assess traffic congestion.

- **Norwegian Public Roads Administration (NPRA) Winter Maintenance Study**

NPRA in coordination with the Norwegian University of Science and Technology tested the use of UAS for avalanche monitoring during winter weather events. Six UAS were tested using four missions: flight over a motocross course to examine “snow covered roads,” a bridge inspection, a flight through a mountainous terrain to examine a simulated avalanche and look for a missing person, and a mountainous flight to examine avalanche hazards. They found that camera and sensor quality were critical to UAS usefulness.

Implementation Considerations (General)	Implementation Considerations (Pro)	Implementation Considerations (Con)
•Any UAS that weighs over 0.55 lbs. must be registered with the FAA and individuals that want to fly a UAS for work must complete FAA testing in order to receive an Airman Certificate. For more information on how to get started, including how to register a UAS and updated UAS regulations. •UAS operators must complete FAA training and registration. •An agency can choose from different types of UAS and UAS capabilities to reduce costs.	•The cost to operate a UAS is much cheaper than the cost to operate a manned aircraft (like a helicopter) for things like search and rescue missions. •UAS can provide real-time imagery. •Improves responder safety. •Provides safe access to high risk areas. •Allows for mapping and photographing a crash scene for quicker crash clearance. •Can cut emergency response time. •Reduces congestion by minimizing the need for lane closures during inspections.	•UAS can be hacked or hijacked. •There is a need to ensure the safety of the UAS and the medicine that is being transported. •Some view drones negatively or as an invasion of privacy. •Operator could crash or lose the UAS, which could cause damage to private property or entail replacement costs.

Opportunities for Future Expansion

- UAS applications like HiRO may become increasingly available as we use more non-motorized modes of transportation. A new UAS designed to transport humans was recently debuted at the Consumer Electronics Show. The Ehang 184 can transport a single passenger and may be helpful for rescuing people in dangerous situations or in locations that are difficult for emergency services to reach. For more information about the Ehang 184, click here.

Additional Resources

- *Federal Aviation Administration (FAA) Unmanned Aircraft Systems Regulations*, found here: https://www.faa.gov/uas/getting_started/
- *FAA Summary of Small Unmanned Aircraft Rule*, found here: https://www.faa.gov/uas/media/Part_107_Summary.pdf
- *The Truth About Drones in Public Safety and First Responder Operations*, found here: http://droneanalyst.com/wp-content/uploads/2016/12/TheTruthAboutDrones_safety.pdf
- *Drones for Disaster Response and Relief Operations*, found here: http://www.issuelab.org/resources/21683/21683.pdf
- 2015 NRITS Presentation: *Evaluating the Use of Unmanned Aerial Systems (UAS) for Transportation Purposes*, found here: http://www.nationalruralitsconference.org/wp-content/uploads/2015/08/Cook_E2.pdf
- 2016 NRITS Presentation: *Unmanned Aircraft Policies and Applications for DOTs*, found here: http://www.nationalruralitsconference.org/wp-content/uploads/2016/10/TN1_ElSaid.pdf
- *State Drone Law: State Laws and Regulations on Unmanned Aircraft Systems*, found here: https://drive.google.com/file/d/0B0l0oAu0n-HhSFk5OWtQR2hmdGM/view

Useful Tip

A UAS purchased for road condition, infrastructure, and traffic monitoring could also be used during a special event to monitor parking lot availability and congestion. This information could be shared via a dynamic message sign (DMS) or an integrated traveler information system.

Cost Range

(Cost/financial information, where noted, is based on 2016 dollars (unless otherwise specified). Cost/financial information is estimated, and will vary based on size and scope of project, number of units, etc. In general, capital costs include initial purchase costs of hardware, software, and other required equipment. Maintenance and operations costs include staff time to operate, monitor and maintain systems; data collection; system upgrades; evaluation; etc.)

Capital Costs: The capital costs for this tool range from low (less than $50,000) to higher (above $250,000) depending on the type of UAS and the UAS capabilities. The Maine State Police purchased a $300 hobby UAS for field operations[1]. Montgomery County, TX purchased a UAS for $300,000. This UAS is equipped with a camera, an infrared camera, and has autonomous flight capabilities. This UAS will be used to keep a bird's eye view of an incident or for tracking down people for search and rescue operations[2].

UNKNOWN

Operations Costs: Estimates of operations and maintenance costs for ongoing use of a UAS are not yet available. Costs will include maintenance of the UAS and training for UAS operators. The current cost for the exam to maintain a FAA certification is $150.

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