

2019 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is Feb. 6, 2019. Submit statements to UTRAC@utah.gov. ***

Title: At the Intersection of Pedestrian Safety and UAS

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Select ONE Subject Area Materials/Pavements Maintenance Traffic Mgmt/Safety Structures/Geotech
 Planning Perf Mgmt/Data Analytics Public Transportation Other

1. Describe the problem to be addressed:

Unmanned aircraft systems (UAS; drones) will play a role in transportation of goods and emergency response throughout urban and suburban areas. While UAS are not constrained to existing transportation infrastructure, road networks represent an opportunity and likely system for travel. Unfortunately, the prevalence of UAS can exacerbate driving distractions (see Oregon DOT, May 2018, Hurwitz et al. *Driving Distraction Due to Drones*) and may cause an increase in motor vehicle accidents and fatalities. The findings of the ODOT study lays a foundation for developing policies to mitigate negative impact. However, there is still a substantial gap of knowledge because there has been no investigation on the influence that UAS have on pedestrian distraction and safety.

Pedestrian-motor vehicle accidents continue to rise in Utah constituting 17% of fatal crashes in 2017 (DPS Fatal Crash Summary) and hundreds of injuries. Nationally, fatality rates are in the thousands per year. Many of these causes are due a combination of poor decisions and distractions both on the part of the driver and pedestrian. Distractions are of particular concern with youth who are more immediately preoccupied by novel environmental elements, sounds and unexpected events than adults. Regardless of age, pedestrian distractions lead to an overwhelming number of injuries and fatalities. Identifying distraction triggers and creating appropriate policies can thus improve safety and public well-being.

We aim to understand how UAS may contribute to pedestrian behavior and distractions, specifically at intersections in urban areas. The push from industry and consumer demand for rapid shipping will pressure existing infrastructure systems (such as the transportation network) and policies. With no study found to date on this nascent topic, we believe that robust research and applied recommendations may save lives in the future and inform state and national policies to balance the growth of UAS in transportation and pedestrian safety.

2. Write the project objective (25 words or less):

To measure the degree of distraction caused by UAS travelling near pedestrians at intersections and then develop regulatory guidelines to minimize pedestrian-vehicle collisions.

3. Explain why this research is important:

(In response, consider addressing specific UDOT goals, applicability in Utah or other states, etc.)

Research on UAS and transportation safety has been focused on drivers and vehicular transportation. However, no research has been conducted on pedestrian-UAS-vehicular accidents. Unlike UAS-vehicle interactions, pedestrians have a higher propensity for hearing and seeing drones because they are not constrained by the vehicle views and noise restrictions from within a vehicle. For UDOT to achieve a goal of less than 200 fatalities per year (Carlos's Top Ten #1 goal; also related to "Zero Crashes, Injuries and Fatalities" in UDOT strategic goals), we will need to find a way to dramatically reduce the 20% of fatalities which are related to pedestrian safety. In addition to studying behaviors at urban intersections, we also intend to evaluate the degree to which children may be distracted by drones near schools or school bus routes.

In 2018, ten new pilot projects involving Apple, Intel, Microsoft, and Uber (Amazon likely to join soon) involve flying drones for delivery, mapping, and surveillance activities in cities across the US. These projects and eventual integration within the transportation fabric is coming swiftly. Thus, there is a sense of urgency to identify issues and concerns grounded on empirical evidence to support sound policies ensuring pedestrian safety. UDOT can play a key role in pioneering practical and relevant research to inform these policies.

4. List the major tasks:

1. Review of the literature (driving distraction, pedestrian safety, and UAS) and the state-of-the-art technologies of pedestrian observation at intersections
2. Develop methodology to systematically evaluate pedestrian distraction in real-world contexts (that could be applied not only to UAS, but other distractions as well).
3. Conduct experiment measuring distraction by studying the following variables:
 - a. UAS frequency: Utah State Investigators have up to 6 UAS that can be piloted simultaneously
 - b. UAS traffic patterns: obeying traffic signals or not; flowing in multiple directions or single
 - c. UAS flight path elevations: no lower than traffic signals or above roadway infrastructure (power lines, light rail power, signage, tree tops)
 - d. Vehicular and pedestrian volume: includes a variety of contexts (built environment, land use, zoning), times of day, and traffic volumes
 - e. Site context: urban intersections, school crosswalks
4. Conduct analyses of observation data and develop regulatory guidelines and report on findings.

5. List the expected deliverables (reports, manual, specification, design method, training, etc.):

1. Final project report containing literature review, research process, analysis findings, and implications
2. Tutorial to monitor pedestrian behavior and distractions in response to UAS
3. UAS regulatory guidelines to minimize pedestrian distraction and vehicle-pedestrian collisions
4. Suite of high-quality graphics, diagrams, illustrations, animations and/or videos of pedestrian-UAS-vehicle interactions, showcasing guidelines and recommendations that UDOT can use or alter for future implementation

**6. Describe how the research results will be implemented:
(In response, consider addressing UDOT leader support, process or standard improvement, etc.)**

The primary application of research results will be the creation of regulatory guidelines that can help UDOT in developing protocols and recommendations to mitigate accidents stemming from pedestrian-UAS-vehicular interactions. We will develop a suite of graphical images, illustration, animations and/or videos that can be used for public outreach, internal communication, facilitate discussions with other state DOTs, Utah Department of Health (UDOH), Utah State Board of Education (USBE), FAA, and urban planning policy makers. Additionally, we will share our methodology for collecting observations and conducting related studies to maximize the effectiveness of future research. The outcomes of the methodology will include metrics to inform the impact of the various test conditions (see major tasks, #3).

7. Requested from UDOT: \$40000 (or UTA for Public Transportation)	Other/Matching Funds: \$35000	Total Cost: \$75000
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8. Outline the proposed schedule, including start and major event dates:

This research is anticipated to take approximately 16 months to complete, according to the following schedule:

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| 2019 | Sep–Oct: | Establish and meet with advisory committee from UDOT, UDOH, USBE and/or local planning and safety commission organizations to refine scope, timeline, and deliverables. |
| | Nov–Dec: | Review the literature and the cutting-edge technologies of pedestrian monitoring |
| 2020 | Jan–Feb: | Develop and test direct observation tools; test UAS effect under different scenarios to inform methodology |
| | Mar–May: | Conduct field surveys and direct observation at sites (see major tasks, #3.e) |
| | Jun–Jul: | Analyze data to measure the degree of distraction caused by UAS travelling near pedestrians |
| | Jul–Aug: | Prepare interim report and receive feedback from technical advisory committee. |
| | Sep–Oct: | Develop regulatory guidelines to minimize pedestrian distraction and pedestrian-vehicle collisions |
| | Nov–Dec: | Prepare a report and package multimedia; present to advisory committee. Revise and submit a final project report, a survey tutorial, and graphics. |