Request for Research Funding for FY 2019-2020			
Requesting Office	State Traffic Engineering and Operations	**Priority** High	1 of 8
Proposed Title	Feasibility Analysis of Real-time Intersection Data Collection and Processing Using Drones		
Justification	Traditional data collection techniques at intersections are known to be time consuming and costly while handling the complexity associated with the heavy traffic volume and travel demand on today's roadways. Therefore, transportation agencies have been searching for more innovative, safer and cheaper data collection solutions in order to have a faster and lower cost collection of traffic data such as traffic volume, speeds, queues, turning movements and conflict points (vehicle to vehicle, vehicle to pedestrian or bicycle, etc.) at intersections. One such innovative solution is using unmanned aircraft systems such as drones. Several states such as New Jersey and North Carolina have already implemented the use of drones (not tethered) for their daily operations such as traffic monitoring and management as well as incident scene data collection, and have reported satisfactory results with their implementation programs[1]. Their experiences have shown that utilizing drones for data collection have demonstrated significant cost savings, and offer substantial safety advantages while reducing accidents and mitigating congestion. According to the AASHTO's 2018 survey[2], drone-based data collection can reduce the time 4 times when compared to traditional data collection methods, and it increases the productivity by 3 times. However, there is still a wide gap in the literature with respect to the efficiency and feasibility of using drones for intersection data collection purposes, especially for longer periods of time during peak hours. To this end, there has not been a study on using the drones for real-time daily traffic collection and processing, and a study related to how this can benefit vehicles, pedestrians and bicyclists. Therefore, a significant challenge in evaluating the feasibility of using drones f(tethered and not tethered) or daily traffic data collection is related to the evaluation of appropriate tools with the rationale and priority for each alternative to be used, developing options and recommendations, and conducting a pilot test at an intersection. Although drones have been used for a variety of purposes such as bridge inspections by other states, the objectives of traffic data collection is totally different inherently. There is also not a study that used tethered drones to collect data on intersections. As such, there is a need to conduct this drone-based feasibility project. A pilot test should be conducted at selected sites in order to collect video recordings of one or all legs of the intersection, and evaluate the feasibility and effectiveness of using drones for real-time traffic data collection (traffic volume, queues, turning movements and conflict points). Based on the data type, the set-up of the drone and associated connections and implementations might be different. The ultimate goal of this project is to identify the cost and time savings associated with such an implementation compared to a traditional data collection method. The following questions will be clearly answered: • Would the use of tethered or not tethered drones provide all the traffic variables FDOT is in need of? • What is the level of accuracy for both types of drones and to what extent both in space and time? This type of data collection also has the potential to improve both traffic operations and safety at an intersection through daily traffic control and monitoring, especially during peak hours. Video image processing techniques should be evaluated to determine their efficacy in acquiring data on queue lengths, turning counts and conflict points (vehicle to vehicle, vehicle to pedestrian or bicycle, etc.) at the intersection. In addition, the following questions will be answered as a result of this project which will be extremely beneficial for FDOT to understand the feasibility of using drones for data collection purposes: • What is the drone technologies of interest (i.e., tethered, untethered, etc.)? • What is the drone-to-ground communication technologies of interest for both tethered and untethered drones? • What is the video imaging processors of interest? • How can we tie these technologies for the collection of desired traffic data (i.e., queue lengths, volumes, speeds, density, etc.)? • What challenges or barriers exist for collecting these data? What data are not easily collectable by drones, and what are some solutions? Based on the best practices and implementations available as well as the associated operational barriers, the research team will identify the standard operating procedures needed to be incorporated for a successful pilot test, and purchase the necessary equipment based on the FDOT Research Program Manual guidelines.		

[1] Baker, C. D., Polito, K. E., and Pollack, S. "The State of the Practice of UAS Systems in Transportation.", Massachusetts Department of Transportation, Boston, MA., December 2016.
[2] AASHTO News, https://news.transportation.org/Pages/NewsReleaseDetail.aspx?NewsReleaseID=1504

Impact	The overall goal of this project is to test the feasibility and efficiency of drone-based real-time data collection and processing at intersections, which can be used by FDOT planners and engineers at various levels of traffic operations and safety analysis. Consistent with this goal, the main objectives of this project are: (a) to extract the vast amount of knowledge with respect to the drone implementations, video image processing software and other related data collection equipment; (b) analyze the results of this search to identify the operational barriers, best implementations, practices and strategies; and (c) conduct a field experiment through a pilot drone study at selected intersections. Meeting these objectives will lead to appropriate recommendations to Florida DOT in terms of evaluating the feasibility of drones as safer, cheaper and faster data collection alternatives, and providing guidelines for successful implementation of a drone-based traffic data collection and monitoring program.		
Affected Offices	The proposed project will involve a range of FDOT Offices and Districts, including State Traffic Engineering and Operations Office, District Traffic Operations, Safety Office, Office of Strategic Development.		
Existing Work	There is no similar research supported in real-time intersection traffic data collection and processing using tethered drones by FDOT for fiscal year 2019/2020. Both the Federal Government and the State of Florida have established regulations for drone operation – using US codes and federal regulations on the federal level and by statute on the state level. FDOT Aviation and Spaceports Office provides this information in details. The research team will comply with all the Federal Aviation Administration (FAA) certifications and regulations as well as the state permits, certifications and regulations.		
Keywords Used In Existing Work Search **(Cannot leave blank)**	Drones, Tethered, Intersection Data Collection, Image Processing		
Related Contracts (Give contract numbers)	N/A		
Funding Request	$150,000	**Anticipated Duration**	12 months
Project Manager	Alan El-Urfali	**Contracting Method**	Direct contract with the Florida State University (Dr. Eren Erman Ozguven)
Urgency	1	There is an urgent need to utilize the drone technology for safer, cheaper and faster data collection at intersections.	
Implementability	1	Specific guidelines and strategies developed can be used by any FDOT district for drone-based data collection purposes.	

Project Benefits (Succinct, complete explanation) In several states such as New Jersey and North Carolina, the use of drones for their daily operations such as traffic monitoring and management as well as incident scene data collection has led to satisfactory results with their implementation programs. Their experiences have shown that utilizing drones for data collection have demonstrated significant cost savings, and offer substantial safety advantages while reducing accidents and mitigating congestion. According to the AASHTO's 2018 survey, drone-based data collection can reduce the time 4 times when compared to traditional methods, and it increases the productivity by 3 times. The ultimate goal of this project is to identify the cost and time savings associated with such an implementation compared to a traditional data collection method. In addition, this type of data collection also has the potential to improve both traffic operations and safety at an intersection through daily traffic control and monitoring, especially during peak hours. Therefore, video image processing techniques will be evaluated to determine their efficacy in acquiring data on queue lengths, turning counts and conflict points (vehicle to vehicle, vehicle to pedestrian or bicycle, etc.) at the intersection. As such, this project will lead to specific guidelines and strategies that can be used by FDOT personnel for drone-based data collection purposes.

Project Benefits **(Select all that apply and explain)**	**Quantifiable Benefits (units, dollars, etc…if applicable)**	**Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits**
o Materials Enhancement		
o Materials Savings		

o Time Savings	Dollars	According to the AASHTO's 2018 survey, drone-based data collection can reduce the time 4 times when compared to traditional data collection methods. This will be even more enhanced by the use of tethered drones, which will be clearly shown as a result of this project.
o Lives Saved/Injuries Prevented	Fatalities and Severe Injuries	Better and faster data collection will significantly enhance FDOT's performance in identifying possible traffic conflict points at intersections between vehicles and between vehicles with non-motorists such as bicycles and pedestrians.
o Productivity	Dollars	According to the AASHTO's 2018 survey, drone-based data collection can increase the productivity by 3 times. With the flying time up-to 15 to 20 hours, tethered drones can significantly increase the productivity.

*Comments should explain and support urgency, financial benefit, and implementability scores