

**ARKANSAS DEPARTMENT OF TRANSPORTATION  
SYSTEM INFORMATION AND RESEARCH DIVISION  
FISCAL YEAR 2021  
REQUEST FOR PROPOSAL  
RESEARCH PROJECT NO. TRC2106**

**TITLE:** UAS LiDAR for Developing Small Project Terrain Models

**ARDOT POLICY**

All proposals shall be submitted electronically per the Proposal section of this Request for Proposal. As of Fiscal Year 2020, all research project contracts will be managed under Info Tech's Doc Express Paperless Contracting platform. All information on the utilization of this platform for research projects can be found at [http://www.ardot.gov/System\\_Info\\_and\\_Research/research.aspx](http://www.ardot.gov/System_Info_and_Research/research.aspx) or from the Research Section.

**PROBLEM STATEMENT**

Providing digital terrain models and survey data for small area projects such as bridge replacements requires obtaining ground elevations in vegetated areas, which is time consuming using conventional total station surveying techniques. Other typical surveying methods, such as airborne photogrammetry, have challenges obtaining ground elevations in the typically wooded areas surrounding the project sites. One of the strengths of LiDAR is the ability to penetrate vegetated areas by obtaining multiple returns to the sensor for a given horizontal position. Unmanned aerial systems (UAS) with a LiDAR sensor can reduce the time and effort required to develop these terrain models without sacrificing the accuracy of the data. UAS LiDAR has advanced significantly in the last 5 years providing easier to use systems with more standardized workflows for developing elevation models from the raw LiDAR data. The project would utilize an aerial LiDAR unit mounted on a UAS. The UAS LiDAR system utilized for the research shall be capable of achieving 0.3' absolute vertical accuracy. The use of UAS is a FHWA Every Day Counts Innovation indicating the technology's ability to make meaningful impacts on transportation projects today.

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**AREA OF STUDY**

The objective of this project is to analyze the benefits of using UAS LiDAR on small projects to obtain terrain models.

**METHOD OF STUDY**

The goal of the project is to assess the accuracy and benefits of using UAS LiDAR to collect high quality survey data for small area projects such as bridge replacements.

1. ARDOT - Surveys Division will coordinate with the Principal Investigator to identify four bridge projects to serve as test sites.
2. Collect and process LiDAR data and compare terrain models developed with LiDAR to terrain models developed utilizing conventional and UAS photogrammetric survey methods and assess the accuracy.
3. Develop standard practices and procedures (best methods) for data acquisition.
4. This study should adhere to FAA guidelines in Part 107.

**BENEFITS**

A detailed cost-benefit analysis shall be included in the proposal. The analysis must include but is not limited to the following:

1. Detailed cost analysis on savings to the Department with full implementation of the projects findings.
2. Any anticipated benefit not foreseen as a cost savings such as employee safety, accelerated construction, and identification of areas needing asset maintenance.

**TIME AND FUNDING OF STUDY**

Work will begin no earlier than July 1, 2020, contingent upon acceptance of the proposal and availability of research funds. The length of the project shall be 24 months. A final report is to be drafted and presented to the Research Subcommittee no later than the last day of the project. Up to 25% of the estimated project costs will be

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withheld pending final acceptance of the final report. Failure to deliver the required Final Report at the end of the project will result in the cancellation of the project and 25% of the total project cost will be retained by the Department.

**REPORTS**

All reports must be in accordance with the 2019 Research Manual (available at [http://www.ardot.gov/System\\_Info\\_and\\_Research/research.aspx](http://www.ardot.gov/System_Info_and_Research/research.aspx) or from the Research Section). All reports are required to be submitted through the appropriate Doc Express process. An Implementation Report which details the recommended means/techniques for using the project results shall be submitted to the Department six (6) months prior to the research project's Final Report. All Final Reports are required to be reviewed by a technical editor before submission to the Department. An oral report to the Transportation Research Committee may be required. In addition to reports and publications, the Department shall be furnished one (1) copy of any master's thesis or doctoral dissertation which is a result of any investigation or study on this project. The submitting of any report to be published by an outside publication or presentation on this project before its completion; shall be submitted for the Department's approval before submission.

**PROJECT DELIVERABLES**

The proposed research will provide ARDOT with a final report and implementation plan to develop UAS LiDAR data for future projects. Conclusions should also reflect the investments of utilizing UAS LiDAR, such as the costs to implement and operate vs established procedures, as well as the Return on Investment that would come with switching to new methods. Project deliverables would consist of, but not limited to:

1. Usable data for current bridge replacement projects which can be directly used in design.
2. Data accuracy verification. Data should be checked by ARDOT and Principal Investigator.

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3. Using collected data, recommended equipment, data collection procedures, software, and workflow; best practices will be established.
4. Breakdown of equipment and acquisition cost of UAS LiDAR data vs. traditional methods (including photogrammetric). Is the cost of implementation justifiable and cost effective?

**AUTHORIZATION TO BEGIN WORK**

A letter separate from the contracting documents authorizing the beginning of work will be transmitted through Doc Express initiating the project. Any cost incurred before the authorization letter is received, will not be eligible for reimbursement. The project will begin work no earlier than July 1, 2020.

**EQUIPMENT**

A complete physical verification of all software and equipment purchased or built for use on this project and the actual location of the equipment will be made each year. An Equipment Capitalization Notice is available from the Research Section for the reporting of software or equipment purchased during the project. All software developed on the project will be completed in open source format and ARDOT shall be provided a copy of the source code. If non-expendable or special equipment is purchased with project funds, the equipment is owned by ARDOT and disposition of the equipment will be determined by ARDOT at the project's closeout session.

All rental rates shall be approved by ARDOT before the approval of the proposals. Should a subcontract be part of the proposal, ARDOT will not approve the purchase of any equipment in the subcontract. Any equipment purchased through ARDOT's Transportation-Related Research Grant Program is not eligible for rental rate charges.

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All equipment shall be purchased in accordance with the State of Arkansas purchasing laws.

**PROPOSALS**

Proposals shall be submitted in two separate electronic formats, a word document and a pdf, to [Research@ardot.gov](mailto:Research@ardot.gov) no later than the end of business on April 3, 2020. This is a firm deadline. All procedures shall be in accordance with the 2019 Research Manual and Federal Aid Policy Guide (FAPG). In the event of policy contradiction, the FAPG shall govern.

Upon approval of the electronic version of the Proposal by the Research Subcommittee the Project Manager will initiate the process within Doc Express to acquire the appropriate electronic signatures from all parties.