

**Project Number**

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Proof of Concept for Using Unmanned Aerial Vehicles for High Mast Pole and Bridge Inspections

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Current Situation

Bridges and high mast luminaires (HMLs) are key components of our transportation infrastructure. Effective inspections are crucial to maintain their structural integrity. Most commonly, inspections are conducted visually by trained, experienced inspectors. Accessing HMLs or the undersides of bridges requires specialized equipment and exposes inspectors to potential hazards.

Research Objectives

In this project, Florida Institute of Technology researchers investigated a system that uses a small unmanned aerial vehicle (sUAV) to assist in the visual inspection process. The sUAV is equipped with a high resolution camera that can transmit video images of structural components.

Project Activities

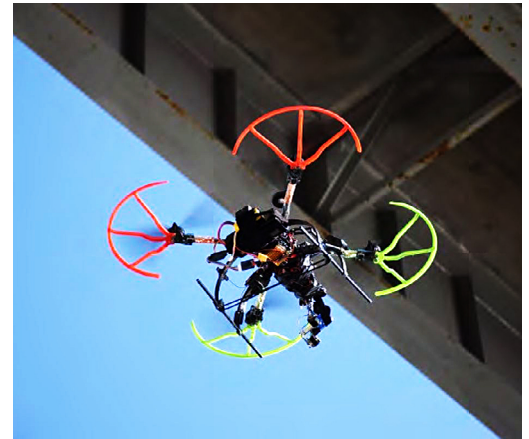
This proof-of-concept study provided many insights into the usefulness and limitations of sUAVs as tools for structural inspections. Initial experiments were conducted indoors using industrial fans to evaluate sUAV flight response in controlled wind conditions, to measure image quality in different flight scenarios, and to determine image quality in low-light conditions. Altitude, payload, and maneuverability tests were conducted to characterize sUAV performance and limitations related to their use for transportation infrastructure inspections. In full coordination with the Florida Department of Transportation (FDOT), limited field tests were conducted to collect images of underside bridge sections and HMLs. The images were of similar or better quality than images collected during traditional inspections.

The experiments demonstrated the potential to fly sUAVs in gusty conditions, maintain safe flying distance of 2-3 feet from a target, and the ability to detect crack sizes down to 0.02 inches. The video system was able to maintain adequate resolution under relatively low-light conditions, highlighting the potential usefulness of UAVs in bridge and HML inspections. Also, a basic sUAV flight training program was developed.

A preliminary cost analysis conducted to estimate the cost of using sUAV as an inspection tool showed potential cost savings in man-hours. Overall, results provided evidence that significant benefits can be obtained from using sUAV during bridge and HML inspections. However, there still exist gaps that need to be addressed in order to use these aerial systems safely and effectively in practice. Various future research areas are identified to close these gaps and increase the general understanding of sUAV for structural inspections.

Project Benefits

By eliminating large inspection vehicles, the use of sUAV as tools for structural inspections can significantly reduce safety risks to both inspectors and motorists. Cost of inspections can be reduced, and the effectiveness and accuracy of structural health evaluations can be improved.



One type of UAV hovers beneath a bridge, eliminating hazards to an inspector who would otherwise be suspended at great height by specialized equipment.

For more information, please see dot.state.fl.us/research-center