UAS PILOT PROJECT - EXECUTIVE SUMMARY
Project ID: 0656-22-11

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The Wisconsin Department of Transportation's (WisDOT) pilot project, to test Unmanned Aerial Systems (UAS) for their use in bridge inspections, was performed by Michael Baker International during the summer, fall, and winter of 2016. Interest in using UAS for various applications within the engineering industry has been growing rapidly in the last few years because they are capable of collecting images, videos, and geospatial data quickly and efficiently. WisDOT decided to investigate this technology's use on bridge inspections with the goals of improved safety for both inspection personnel and the traveling public, efficiency in the collection and report, and quality of documentation.

WisDOT's team determined an initial list of structures as potential candidates for a UAS inspection. These structures ranged in type from overhead truss, to deck truss, to steel girder bridges. The project team narrowed down the list of the preferred sites to include different types of structures and crossings including a continuous steel deck girder bridge in Milwaukee (B-40-115) over a former rail yard, a continuous steel deck girder bridge near Dekorra crossing the Wisconsin River (B-11-22), and an overhead truss bridge near Steuben (B-12-363) crossing the Kickapoo River.

Pix4D preliminary point cloud of bridge deck B-11-22 in Dekorra, WI.

Data collected from the UAS was processed and the products were point clouds, georeferenced photos, and photo and video documentation. The point cloud of the gusset plate was modeled and used to pull measurements of the gusset plate in order to detect any deformities. A point cloud of the bridge deck was created to show detail of the deck surface and quantify any deck defects. Georeferenced photos were developed in Google Earth to show locations of specific photos taken with the UAS.

Lessons learned to consider for future projects include:

- A site visit beforehand was useful in preparing a collection plan and determining a suitable staging area.
- Planning for the weather was also pertinent to the success of the mission. Temperatures below 50 degrees greatly reduced battery life, so measures had to be taken in order to keep batteries warm and functional. Warm weather inspections likely won't have this issue.

- In order to maintain a safe distance from the structure, the UAS wasn't able to get images of the top of the (interior) bearings or the top of the bottom flange of the girders. A micro UAS was tested for this purpose with relative success, but it should be noted that image quality and flight predictability from that small of a UAS was notably reduced as compared to the Falcon 8 and the Inspire 1.
- The use of First Person Viewing (FPV) goggles was well received by the inspectors due to their ability to allow the user to see what the UAS sees. These, paired with a hand-held controller for camera functions, allowed the inspectors to take specific photos as well as have some control over what they were viewing with the UAS.

Zoomed in image of a bearing taken from the Falcon with the Sony A7R.

In summary the UAS could act as a screening tool for future bridge inspections, as well as provide detailed documentation of inspections for comparison purposes. The UAS could provide supplemental information such as quality photos and thermal imagery that will provide better information to the Region maintenance engineers as they plan, schedule, and prioritize rehabilitation projects. From a safety perspective, operating the UAS while being separated from traffic kept the inspectors and pilot away from the vehicles traveling on the highway. The traveling public was also not impacted by a lane closure for the snooper truck and equipment. Next steps for this project could include parallel inspections comparing traditional bridge inspection methods to bridge inspections utilizing a UAS. This pilot project demonstrated the advantages to using a UAS and it will be important to continue to test this emerging technology as advances and new capabilities are developed that enhance the bridge inspection operation.