Michigan Department of Transportation

Unmanned Aerial System Use Case

Need Statement

At this site, UAS data along a road corridor of US-31, 14 miles north of Muskegon, Michigan were collected including a bridge over the White River. By providing a right-of-way along a road corridor, and a bridge, this site helped combine a demonstration of longer-distance monitoring with a bridge survey. The bridge has a length of 169 feet and width of 43 feet. A 2014 detailed MDOT bridge scoping report indicates that 13.6% of the bridge has delaminations and approximately 300 square feet of concrete patching; for a bridge deck rating of 4 (Poor condition). For this site, imagery using the Nikon D810, DJI Phantom 3A, DJI Mavic, Flir Vue Pro, Flir Vue Pro R, Flir Duo, and GoPro Hero3 were collected, including traffic video. UAV-enabled data collection capabilities was deployed to demonstrate the efficiencies of rapid, high quality data sets using these sensory technologies. GIS-based layers created include an optical orthophoto, Digital Elevation Model (DEM), and hillshade were created on the back-end (office). Thermal orthophotos with both relative temperature values and radiometrically calibrated per-pixel values and an orthomosaic of the underside of the bridge were also created.

Justification

Demonstrated how implementing UAV technologies into Michigan DOT (MDOT) workflows can provide many benefits to MDOT and the motoring public, such as, advantages in improved safety, cost-effectiveness, operational management, and timely maintenance of the transportation infrastructure.

Sensor Package

Thermal image of the US-31 north-bound bridge in Muskegon, Michigan was collected with the FLIR Vue Pro R sensor, with different temperatures on the bridge deck potentially indicating defects. Brighter yellow colors are warmer while darker purple colors are cooler. With the Pro R version, these colors can be turned into per-pixel temperature values identifying bridge deck spalling and delamination. Data collection using a thermal imagery of the US-31 road corridor with dual FLIR cameras.

Platform

Bergen Hexacopter Unmanned Aerial Platform

Success and Lessons Learned
Data collection from these sensory technologies have shown the potential benefits of implementing UAV into MDOT workflows. These technologies will help with many transportation management and operations data needs, including providing MDOT with updated methods to collect needed bridge element inspection data including identifying spalls with optical images and likely delaminations with thermal data.