Michigan Department of Transportation

Evaluating the Use of Unmanned Aerial Systems (UAS) for Transportation Purposes

Steven J. Cook, P.E.
Engineer of Operations & Maintenance
Challenges for Public Sector Use

• Federal Aviation Administration regulations
• State legislation
• Internal policies & procedures
• Public perception
• Liability
UAS Benefits for Transportation

- Safety
- Mobility
- Savings
- Efficiency
- Legacy Liability
- Economic Development

Minimize Lane Closures

Business Development
MDOT Research Phase I - UAS Possible Applications

- Aerial inspections - infrastructure condition state and assets management
- Confined space inspections
- Traffic operations monitoring
- Photo imaging (high resolution photogrammetry)
- Thermal infrared technologies
- LiDAR surveying and mapping
**UAV Platforms**

- Bergen Hexacopter ($5,400)
- Mid-sized UAV – Phantom ($800)
- Micro UAV ($150)
- Blimp ($1,000)
Non-Destructive Evaluation of Bridge Elements

- Used to detect surface conditions
  - Bridge deck delamination, potholes, cracks, patching, etc.

- Overlapping imagery can be used to generate 3D models to characterized condition state of deck bridge
Transportation Infrastructure Forensic

- Scour failure January 16, 2016, in Greece (University of Michigan)
- Failure location was physically inaccessible due to river
- Failure was mapped using high resolution photogrammetry principles
- Mapped using 649 photos from a UAS at different points of view

Modeling the information from the field provided:
- 3D point cloud
- Longitudinal cross-section
- Horizontal plane section to remove the bridge decks
- Bridge pier displacement, horizontal rotation and vertical inclination
Traffic Operations
Construction site imaging

Waterproof UAV for underside imaging of bridges over water
Confined Space Inspections

- Capability to fly in confined spaces
  - MDOT Pump Stations

- Is it safe to send a person in?
  - unlit spaces
  - assess environmental condition state (air quality, etc.)

- Successfully tested with live video feed via iPhone
Mapping Condition State of Unpaved Roads

3D point cloud of an unpaved road using photo/image reconstruction

Aerial photo of unpaved road from UAV

3D mapping of potholes on unpaved road
**UAV Thermal Infrared Scanning**

- Detection of subsurface condition
- Infrared imagery automatically detects delamination (left, green polygons)
UAV Crash Reconstruction - Traffic Incident Management
MDOT UAS Phase II Research (April 2016 – 2 year project)

1. Data collection capabilities
2. Use broad sensing technologies for three (3) MDOT assets
3. Ensure data collected accuracy/quality compared to current data collection systems at MDOT
5. Determine the return on investment (benefit/cost analysis)
6. Secure an FAA COA or Section 333 Exemption
Thank you!