Bridge and Communication Tower Inspections with Small Unmanned Aircraft Systems (sUAS)

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• 1/9 Bridges are deficient [1]
• 200 million trips per day [1]
Outline

- Traditional Inspections Methods
- Inspections with UAS
- Independence Bridge
- Washburn Butte Tower
- Mill Creek Bridge
- Crooked River Bridge
- Conclusions and Future Work
Traditional Inspections

Problem:

FHWA requires an inspection once every two years [2]

Advantages:

• Arm's reach inspection
• Possible to probe and clean

McDonald Memorial Bridge [3]
Traditional Inspections

Disadvantages:

- Lane Closures
- Climbing gear
- Expensive to mobilize equipment

Problems:

- “Bridge inspections are inherently dangerous” [2]

Municipal Bridge Inspections [4]
Traditional Inspections

• Possible Solution?
Unmanned Aircraft System aided Bridge Inspections

Advantages:

- Vertical Take-offs and Landings
- Hover in place
- Low Altitude flying for advantageous view angles
Unmanned Aircraft System aided Bridge Inspections

Disadvantages:

• GNSS dependent for positioning

• Unable to perform contact based inspection
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Traditional Inspections

Inspections with UAS

Independence

Washburn Butte

Mill Creek

Crooked River

Conclusions
Inspections with UAS

Independence

Washburn Butte
Mill Creek
Crooked River

Conclusions
Independence Bridge Lessons

- High resolution images are capable from consumer grade UA
- Bottom mounted camera is not ideal.
- Different platform could improve results further
Washburn Butte Tower

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Traditional Inspections  Inspections with UAS  Independence  Washburn Butte  Mill Creek  Crooked River  Conclusions
Washburn Butte Tower Lessons

• Flying planning software for albris does not allow for high enough resolution

• Signal Jamming is a real problem
  • WISPs

• Point Cloud is useful for making measurement as well as creating a index for your photos

• Potential for making a more quantitative analysis of bridge
Mill Creek Bridge

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Inspections with UAS

Independence

Washburn Butte

Mill Creek

Crooked River

Conclusions
Mill Creek Bridge

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Mill Creek Bridge

Traditional Inspections

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Mill Creek Bridge Lessons

- Front mounted camera allows for looking up under the bridge
  - However, still difficult to see soffit in some cases is still difficult
- Great imagery that could be improved with a more experienced pilot
Crooked River Bridge
Crooked River Bridge
Crooked River Bridge
Crooked River Bridge
Crooked River Bridge Lessons

- Birds and wind can shut a day of flying down
- Great imagery, careful with lighting
- 3D point cloud possible from the manual flights done on this bridge
Conclusions and Future Work

• The UAS collected imagery that would be beneficial to a bridge inspector in identifying potential defects that need attention.

• Point Cloud/Model can be useful for making measurements

• Follow-up with Bridge Inspectors from ODOT

• Follow-up studies, testing different bridge types as well as sensors, are on going

• Procedures for implementing UAS safely in inspections
References


