

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

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UAS Mapping
Sponsored by ASPRS.



- 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



McDonald Memorial Bridge [3]

Problem:

FHWA requires an inspection once every two years [2]

Advantages:

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

Traditional Inspections



Municipal Bridge Inspections [4]

Disadvantages:

- Lane Closures
- Climbing gear
- Expensive to mobilize equipment

Problems:

- “Bridge inspections are inherently dangerous”
[2]

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

Independence Bridge



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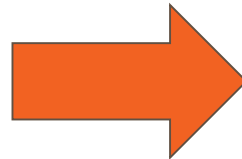
Mill Creek

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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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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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



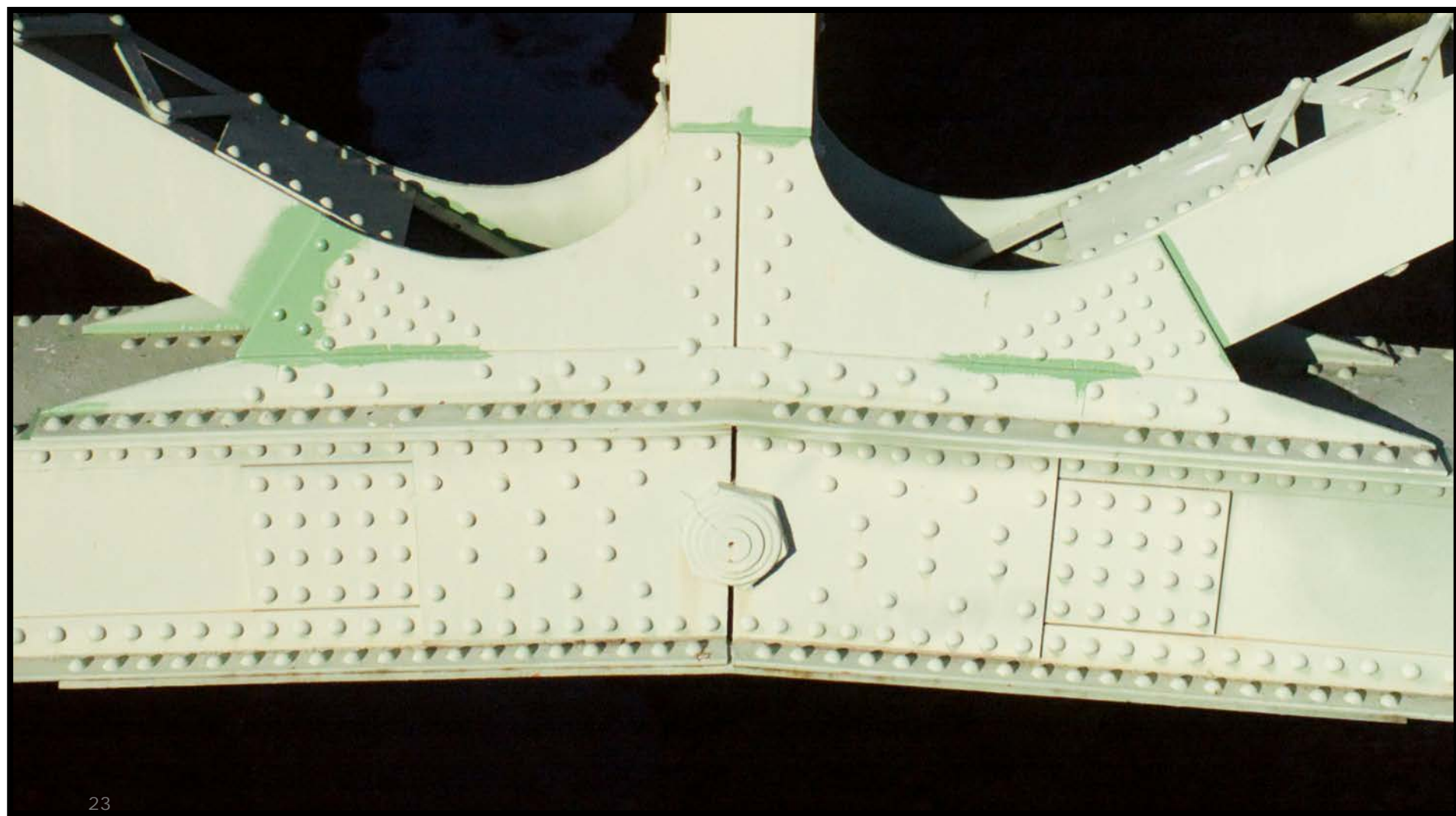
Crooked River Bridge



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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



QUESTIONS?

References

- [1] American Society of Civil Engineers (ASCE), (2013). "2013 report card for America's infrastructure; bridges:" <http://www.infrastructurereportcard.org/a/#p/bridges/overview> > (October 27, 2014).
- [2] Ryan, T.W., Mann, J. E., Chill Z. M., Ott B. T. (2008). "Bridge Inspector's Reference Manual (BIRM)." 984 pp.
- [3] <http://www.trcsolutions.com/projects/transportation/phil-g-mcdonald-memorial-bridge>
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- [5] Federal Aviation Administration (FAA), (2015a). "Fact Sheet – Unmanned Aircraft Systems (UAS)." FAA, < https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=14153 > (last date accessed: 3 Dec 2015).
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