

SUAS IN INFRAESTRUCTURE INSPECTIONS: MIAMI METRORAIL TRACKS

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THANKS TO THE COLLABORATION OF

MIAMI-DADE COUNTY

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THE MIAMI METRORAIL



THE TRADITIONAL WAY OF DOING VISUAL INSPECTIONS



METHODOLOGY USING sUAS (small Unmanned Aerial Systems)



DATA COLLECTED



THE TRADITIONAL WAY VS USING sUAS



FUTURE APPLICATIONS







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Opened in 1984, it is Florida's only rapid transit metro system, and is currently composed of two lines of 23 stations on 24.4 miles of standard gauge track. The system transports 70,000 daily passengers in 2018.



THE METRORAIL Ø



THE TRADITIONAL WAY OF DOING VISUAL INSPECTIONS



TRADITIONAL WAY PROJECT WORKFLOW



SET DATE FOR INSPECTION

WALK THE PLATFORM

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VISUALLY INSPECT TOP OF GUIDEWAY



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TAKE PICTURES, TAKE NOTES OF ISSUES

WRITE REPORT

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MANUAL VISUAL INSPECTIONS

Bi-yearly inspection of the top of the guideways: Inspecting for vegetation, tree encroachment, drainage issues, debris, cracks in concrete, conditions of sound barriers, etc.

- Humans working...
- ✤ At high elevations.
- Walking several miles each time.
- Manual identification of issues prone to human errors.
- Data collected limited to logs, and photos taken manually with a tablet at the inspector's discretion.

Slow process.



METHODOLOGY USING SUAS







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CONCEPTION & INITIATION

MISSION PLANNING

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- Scope of the inspection (SOW).
- Goals.
- Expectations and acceptance criteria.
- General safety assessments of the required inspection.
- Legal compliance analysis.
- Identification of operational constrains and limitations of the current technology.

USING sUAS CONCEPTION & INITIATION





Aircraft selection



Sensor characteristics

USING SUAS

PROCESSING

CONCEPTION **MISSION** > & INITIATION PLANNING COLLECTION UNITED STATES OF AMERICA X DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATIO IV NAME XXXXXXXXXXXXXXX NATIONAL WEATHER SERVICE Oceanic and Atmospheric Administration U SEX HEIGHT WEIGHT HAIR EYES VI NATIONALITY USA Na D.O.B. XXXXXXXXX **REMOTE PILOT** XXXXXXXXXX XXXXXXXXXX III CERTIFICATE NUMBER X DATE OF ISSUE 5 Training and certifying pilots





Sensor characteristics

Planning around weather

Image source: https://aerdia.com/2017/01/17/new-drone-owner/





QUALITY CHECK

Risk Management System







Example of platform evaluation and selection process









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CONCEPTION & INITIATION

MISSION PLANNING



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At least one Remote Pilot in Command and one Visual Observe systematically fly the tracks at the same distance from the track, the same angle and creates overlapping photos.

Operational challenges Flying within Visual Line of Sight. Not flying over people not involved in the operations. Requires highly skilled licensed pilots. Requires FAA: COA's and/or COW's. Electromagnetic interference. Weak or no GPS signal when flying close to tall buildings.

USING sUAS DATA COLLECTION







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CONCEPTION MISSION > & INITIATION PLANNING

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Input Stage

- Sensor collected data
- sUAS collected data
- Data transmission
- Data encoding

Processing Stage

- Transform raw data into information
- Perform instructions

USING sUAS DATA PROCESSING ...







Output Stage

- Exporting files
- Report preparation
- Data visualization

Storage Stage

- Storing data
- Retrieving data

USING sUAS **QUALITY CHECK**

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- images are suitable for analysis. Post project debriefing. Learned lessons.
- Identification of opportunities for improvement.



Check if the data is complete, the methodology was followed, and the



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DATA COLLECTED





ALERT 5 INTERNATIONAL LLC DATA CHARACTERISTICS

All processed data is:

- Organized and cataloged on HD.
 Georeferenced and time stamped.
- Complete.
- Consistent from beginning to end.
- Non redundant.
- Relevant.
- Comments on issue areas.







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May 14, 2019 3:05:42 PM		0	4864x3648	Select 👻	

THE TRADITIONAL WAY

VS USING UAS



TRADITIONAL WAY

- Requires advanced scheduling
- Low resolution with limited photos that may or may not be stored.
- Points of views limited to the ground and to site access
- Delayed insights
- High costs: Labor and insurance
- Humans in risk for accessing dangerous locations to collect data

TRADITIONAL VS USING SUAS

USING sUAS

- ✤ On-demand
- High resolution
- Unlimited points of views from a three-dimensions space
- Quick insights
- Low cost
- Low risks
- Quality data accessible 24/7







ORIGINAL IMAGES IN 4K QUALITY

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ISSUE DETECTION ON IMAGES AND ANNOTATION



AUTOMATIC DETECTION OF PRESENCE OF **VEGETATION IN CRITICAL AREA**





DETECTION OF DELAMINATION USING sUAS with INFRARED/RGB SENSORS



Source of image: https://www.mdpi.com/2313-433X/2/2/11/htm





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