WORLD OF DRONES CONGRESS™
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Drones: Enhancing work safety

Verification of drinking water reservoir integrity using ROV drones
Andrea Clement (Seqwater)

Maximising opportunity - A case study in the emerging application of UAV at Holcim’s Beenleigh Quarry
David Arnott (Holcim (Australia) Pty Ltd)

Drone enhanced safety for structural inspection Balaclava Island case study
Fred Doyle (RoadTek, Department of Transport and Main Roads)

Removing people from hazards
Rob Korbee (PowerFox)

Drones at Amrun
Quinton Johannes, Joanna Winters and Rob McHattie (Bechtel Australia)
Drones: Enhancing work safety

Verification of drinking water reservoir integrity using ROV drones
Andrea Clement (Seqwater)
Verification of drinking water reservoir integrity using ROV drones
Andrea Clement
Introduction

• Seqwater supplies >3 M people with drinking water
  • 26 dams and 51 weirs
  • 37 water treatment plants and Gold Coast Desalination Plant
  • 600+ kilometres of network operations including **77 Drinking Water Reservoirs**
Contents

• Why is asset integrity surveillance so important?
• How does ROV technology contribute to our asset management system
• Limitations, Challenges & Key leanings
• Outcomes
Water quality issues - organic matter

Sanitary integrity protects drinking water from intrusion of pathogens
Water quality issues - organic matter

Possible Salmonella contamination

Possible protozoans contamination
Contamination of drinking water

- Salmonella typhimurium outbreak in Gideon, Missouri in 1993.
- Cryptosporidium outbreak in Northamptonshire, United Kingdom in 2008.
## Asset management - condition rating process

### Condition rating matrix

<table>
<thead>
<tr>
<th>Rating</th>
<th>Defects</th>
<th>Details</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>New asset</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>None</td>
<td>Nearly new asset</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>Influencing condition</td>
<td>MinorMaintenance</td>
<td>3 months</td>
</tr>
<tr>
<td>4</td>
<td>Influencing operation</td>
<td>Major maintenance</td>
<td>1 month</td>
</tr>
<tr>
<td>5</td>
<td>Influencing condition &amp; operation</td>
<td>Asset replacement</td>
<td>Immediately</td>
</tr>
</tbody>
</table>

### Summary of defects identified

- Defects influencing condition: 40
- Defects influencing operation: 150
- Defects influencing condition and operation: 20
Defects influencing condition

Overflow - Bell Siphon
protective coating comes off

Corrosion at inlet pipe
Defects influencing operation

Holes in reservoir roof
Defects influencing condition and operation

Defects in roof sheeting
Box guttering corroded and falling inside reservoir

Damaged baffle
Limitations, Challenges & Key learnings

Limited ability to identify subsurface defects

Limited ability to identify breather mesh integrity
Why ROV drones?

• Conventional surveillance methods
  • Subjective data
  • Control measures are expensive

• ROVs are an effective alternative
  • Objective data trending
  • Elimination of safety & drinking water quality risks
Implementation of innovative technology at Seqwater

ROV to inspect the reservoir internally

UAV to inspect the reservoir externally

Robots to clean out sediments inside the reservoir
Outcome – integrated system

• Integrated sanitary and structural integrity
  • Effective asset maintenance planning & renewal program
  • Objective and cost effective data collection & evaluation
  • Elimination of safety and water quality risks
Drones: Enhancing work safety

Maximising opportunity - A case study in the emerging application of UAV at Holcim’s Beenleigh Quarry

David Arnott (Holcim (Australia) Pty Ltd)
Maximizing Safety & Opportunity

A case study in the emerging application of UAV at Holcim’s Beenleigh Quarry
Application of UAV technology within Holcim (Australia)
Stockpile management and volumetric analysis
Adherence to mine plan and conformance to design
Drill & Blast design and monitoring blast performance
Accessing inaccessible areas
Observing hazards from afar
When a incident results in other potential risks
Squeezing the Resource
UAV adding value
Return on investment
Return on investment
Change Process
Birds
Weather
High Voltage Power Lines
Flight Time & Optimal Design
Drones: Enhancing work safety

_Drone enhanced safety for structural inspection Balaclava Island case study_

Fred Doyle (RoadTek, Department of Transport and Main Roads)
Drone Enhanced Safety for Structural Inspection

Balaclava Island Case Study

World of Drones Congress 2018

Presented by Mark Steedman
Principal Manager, Structures Management Services
RoadTek – Department of Transport and Main Roads
values, our diversity
Overview of Presentation

1. Background – current state and future need
2. Structures inspection – what do we do?
3. Research and development (R&D)
4. Technology and the market – what is available
5. Prototypes and field testing - terrestrial
6. Balaclava Island – case study
7. Prototypes and field testing – aerial
8. Acceptance criteria
9. Analysis of cost saving
10. Conclusion
Background

- Inspector access is major safety issue
- RoadTek safety/innovation/customer focus
- R&D project created
- Inspection techniques with safety focus
- Investigate low cost/high tech market sector
- Prototypes and field testing
- Proof of concept
- Report
Structures inspection

1. Ground-based inspections for difficult or dangerous to access structures
2. Air-based inspections for structures requiring access using an Under Bridge Unit or Elevated Work Platform
3. Data recording and system data entry.
Research and development

Scope and defining success
• Implementing technology to enable safe and cost effective solutions
• Acceptance criteria set for inspection data quality
• A simple ‘need’ statement for inspection devices:

“To adopt a combination of existing ‘off the shelf’ technologies to create a “vehicle” carrying a “camera” able to safely reach ‘difficult/dangerous to access structures and structure components to provide high quality video and still images to enable structure condition assessment”.
Technology and the Market

- A combination of components and ‘off-the-shelf’ devices
- High tech – low cost (hobby)
- Flexibility to target a solution.
Prototypes and field testing

Terrestrial Inspection Vehicle ‘evolution’
Prototypes and field testing

Terrestrial Inspection Vehicle ‘evolution’
Balaclava Island location

Source: Mapcarta
Balaclava Island location

Source: Mapcarta
Balaclava Island history

The old tower is toppled and caught falling as it makes way for the new tower in 1932.

Lightkeepers' children at Balaclava Island pose with a good haul of mud crabs.

Fred Doyle
RoadTek’s Project Manager


A king tide on Balaclava Island surrounds the lightkeeper's cottage, c. 1931

The completed rear tower, circa March 1932
Prototypes and field testing

• Back to the R&D project
Prototypes and field testing

Aerial Inspection Vehicle
Prototypes and field testing
Prototypes and field testing
Prototypes and field testing
Data quality and acceptance criteria

The acceptance criteria is…

• a RoadTek Senior Structures Inspector accepting the quality of the image data to enable an effective and conforming Level 2 Structure Condition Assessment to be performed.

…and was achieved.

• RoadTek was awarded the rehabilitation contract.
Working on an island
The final product
The final product

Address: 928 Reedy Creek Road
Analysis of potential cost saving

Aerial Inspection Device

- Cost to purchase: approximately $2000
- Drone flight time = 18 minutes total
- Recovery cost (nom): $100 per day?
- Subcontract cost: approximately $1500 per day?

- Balaclava Island: approximately $250,000 to establish and operate ‘traditional EWP’
- Significant ‘start-up’ costs for licencing and training.
So what’s next?

Underwater Inspection Device
Conclusion

• Need identified – improvement focused on safety and cost saving for our customers
• Open-minded approach to consider innovation and in-house development and implementation
• Important to manage perceptions!
• The potential of structures field staff has been unleashed – they are working with remotely controlled vehicles and tablet devices as routine methods to do work.

Anyone can do this!
Thank you and stay connected

Twitter  @TMRQld
Facebook @TMRQld
LinkedIn  Department of Transport and Main Roads
Blog    blog.tmr.qld.gov.au
Drones: Enhancing work safety

Removing people from hazards
Rob Korbee (PowerFox)
Drones in Confined Spaces

Removing People from Hazards

*Case Study endorsed by Millmerran Power*

Presented by Rob Korbee

at

Workshop “Drones: Enhancing work safety”
in conjunction with World of Drones Congress
9 August 2018, Brisbane Exhibition and Convention Centre
“Fifty-nine confined space related deaths were identified over the period 2000–2012, or 0.05 deaths per 100,000 workers across Australia.”

Hazards of Confined Spaces

Not designed for human occupation:

Examples of hazards:

- Unsafe oxygen levels
- Chemical contaminants
- Poor visibility
- Engulfment
- Fire or explosion
- Structural hazards, slips, falls
Why Drones?

Drones are remotely controlled and have a high potential to:

**Improve Safety:**
- Physically separate people from hazards
- No entry = no Confined Space (CS) hazards
- Avoid or reduce number of, climbing and scaffolded activities

**Do things faster:**
- Simpler inspection process
- Quicker than people
A Practical Case:
Inspection of a Coal-Fired Boiler
Mission

Inspect for visual defects:

- Roof
- Tubes
- Walls
- Burners
- Bottom

50m

this is a person

23/08/2018
Drone Selection

Collision-tolerant Elios to navigate through complex structures and:

- Fit through <25” manhole
- Have steel proof communication
- Stream live video feed
- Produce close-up high-res images
Project Execution

✓ Preps: Project & flight plan, safety assessment
✓ On-site: Inspection flights
          Preliminary findings
          Raw videos
✓ Off-site: Data processing & structuring
          On-line reporting

Typical turnaround a few days
Inspection Video Footage

A 3 minute compilation of flights inside the 50m tall boiler
Results

- 30 unique drone flights (4hr flight time)
- 20 GB video recordings
- 42 documented points of interest
- 33 selected video fragments
- Summary of observations
Value to End User

- Eliminating the need for significant scaffold (cost & time)
- A safety improvement by avoidance of some confined space entry and reduction of scaffold work
- Allowing for access to, and additional inspection of areas we would not normally get to during this outage
- Survey a lot of areas in a short time which helps in early decision making on any repair work, with a flow on effect of improved quality and reliability

*In this case, Millmerran Power was able to reduce a work scope for the next few days by an amount that paid for the drone inspection!*
Conclusion

✓ Drones can safely conduct visual inspections of Confined Spaces and, by reaching locations that would not otherwise be accessible, enhance the scope & quality of the inspection.

✓ The use of drones can help reduce the frequency and duration of people being exposed to hazards within Confined Spaces.

✓ The use of drones can simplify as well as speed up the process of doing & managing Confined Space work and thereby provides a good return-on-investment.
Outlook

There is significant future opportunity for the industry to improve safety and reduce cost using drone technology
Questions?
Drones: Enhancing work safety

Drones at Amrun
Quinton Johannes, Joanna Winters and Rob McHattie (Bechtel Australia)
Drones at Amrun

August 2018
Introduction

• **Jo Winters**  
  Specialist – Communities, Communications and Project Risk

• **Quinton Johannes**  
  Project Site IS&T Lead

• **Rob McHattie**  
  Structural Designer and Construction Support
About Amrun
About Amrun

On track to deliver a safe, high quality bauxite mining operation
Amrun’s drone program

- Self-operated drone program commenced in April 2017, with sub-contractor component.
- Used for GIS mapping, construction progress monitoring, stockpile estimations, environmental monitoring, construction inspections and punch-listing activities, photography, videography, community engagement, and more.
- Four types of drones in use:
  - Mavinci – mapping and stockpile estimations
  - Falcon 8 – hi-res images for construction inspections
  - Inspire Pro 2 – construction monitoring, progress photos, videos and environmental monitoring
  - Phantom Pro 4 – progress photos, videos and environmental monitoring.
- Eight pilots with Multirotor (25kg) and/or Fixed Wing (7kg) licences.
Use case examples from Amrun

- **Punchlisting Communications Towers:**
  - Amrun has six 70-metre tall communications towers to support site communications (radio/phone/computer networks).
  - Prior to sign-off of any construction, punchlisting inspections occur to identify any outstanding works.
  - Instead of sending employees up in an elevated work platform, drones were used in the first instance to identify any outstanding works.
- **Suitable drones for this task:**
  - Inspire Pro 2
- **Core benefits:**
  - Reduction in working at heights activities
  - Reduction in equipment usage (EWP)
Use case examples from Amrun:

- **Inspecting hard to reach places**
- Amrun’s Chith Export Facility required inspection of infrastructure, painting and other works underneath the jetty.
- Utilising the Falcon 8 with VR goggles, the drone team were able to work closely with Engineers to ensure the required images were capture.
- **Suitable drone for this task:**
  - Falcon 8 (with VR goggles)
- **Core benefits:**
  - Reduction in working at heights and working over water activities
  - Reduction in equipment usage (scaffolding, marine fleet)
Use case examples from Amrun

- **Construction progress monitoring and photography/videography**
  Program enables instantaneous progress monitoring for weekly/daily/monthly construction reporting activities and supports the capturing of photos and videos for use in presentations, Project communications and videos.

- **Suitable drones for this task**
  - Phantom Pro 4
  - Inspire Pro 2

- **Core benefits**
  - Reduce reliance on third parties for photography/videography requirements (i.e. film crew, helicopter photographer).
  - Timely photography and videography activities to support reporting.
Drones – enhancing workplace safety at Amrun

• Utilising drones at Amrun has enhanced workplace safety by eliminating the need for some high risk activities.
• It has also reduced the need to use equipment in some cases, and the reliance on third-party subcontractors.
Thank you for attending the

Drones: Enhancing work safety workshop