

## Structural Inspection and Defect Detection with Drones



*Guided field mission planning with groups*



*Birds eye view of construction site used as practical*



*Labeled exercise buildings with faults identified during practical session*

OVERVIEW	
<b>Flying Labs</b>	Zambia Flying Labs
<b>Location</b>	Lusaka, Zambia
<b>Date</b>	18th - 21st September, 2023
<b>Length (number of days)</b>	4 days

<b>Sector program (optional)</b>	<a href="#">DevRobotics</a>
<b>Format</b>	In-Person
<b>Co-organizer if applicable</b>	Association of Consulting Engineers of Zambia
<b>SDGs</b>	<a href="#">GOAL 4: Quality Education</a> <a href="#">GOAL 9: Industry, Innovation and Infrastructure</a> <a href="#">GOAL 11: Sustainable Cities and Communities</a>

SCOPE & OUTCOMES	
<b>Type of training</b>	Technical training of professionals.
<b>Goal of the training</b>	<ol style="list-style-type: none"> <li>1. Create drone awareness.</li> <li>2. Develop drone data acquisition skills.</li> <li>3. Develop drone data analysis skills.</li> <li>4. Develop data literacy/interaction skills.</li> </ol>
<b>Expected outcome for participants</b>	<p>The participants expected to gain the following by the end of the training;</p> <ul style="list-style-type: none"> <li>● Enhanced surveying and mapping skills</li> <li>● Improved inspection proficiency</li> <li>● Advanced data collection</li> <li>● Efficiency in monitoring</li> <li>● Safety protocol adherence</li> <li>● Cost-efficiency recognition</li> <li>● 3D modeling and simulation</li> <li>● Enhanced communication</li> <li>● Regulatory compliance</li> <li>● Environmental assessment</li> </ul>
<b>Confirmed outcome after training</b>	<p>The training objectives were met with participants pleased with the use case of drones in structural inspection. They also emphasized the need to increase time allocated for practical sessions. The training focused on individualized practical sessions where everyone collected their own datasets for processing.</p>
<b>Eventual next steps</b>	<p>To conduct newsletters updates on the improvements in structural inspection with drones.</p>

PARTICIPANTS	
<b>Profiles and number of participants</b>	9 Staff from the government. 3 professionals (individual consultants).
<b>Name of participants' organizations</b>	<ul style="list-style-type: none"> <li>● National Power Utility Company (ZESCO) - 9 participants</li> <li>● GOPA INFRA - 2 participants</li> <li>● Individual - 1 participant</li> </ul>
<b>Gender ratio</b>	11 male: 1 female
<b>Who paid for the training?</b>	The Association of Consulting Engineers of Zambia.
<b>Participant fee rate (if applicable)</b>	USD 280 per participant.
<b>Scholarships offered?</b>	None.

CONTENT	
<b>Training components</b>	<p><b>I. Introduction</b></p> <ul style="list-style-type: none"> <li>● Welcome and Introduction to the Training Program</li> <li>● Importance of Structural Inspections and Defect Detection</li> <li>● Role of Drones in Modern Inspection Practices</li> </ul> <p><b>II. Drone Technology Overview</b></p> <ul style="list-style-type: none"> <li>● Types of Drones Used in Structural Inspections</li> <li>● Key Components and Features of Inspection Drones</li> <li>● Regulations and Safety Guidelines for Drone Operations</li> </ul> <p><b>III. Preparing for Structural Inspection</b></p> <ul style="list-style-type: none"> <li>● Site Assessment and Planning</li> <li>● Pre-flight Checklist and Safety Protocols</li> <li>● Securing Necessary Permissions and Clearances</li> </ul> <p><b>IV. Conducting Structural Inspection</b></p>

- Capturing High-Quality Images and Videos
- Real-time Data Transmission and Monitoring
- Utilizing Specialized Sensors for Defect Detection

#### **V. Post-Processing and Data Analysis**

- Data Storage and Organization
- Introduction to Image Recognition and Machine Learning
- Software Tools for Data Analysis and Reporting

#### **VI. Interpreting Inspection Data**

- Identifying Structural Defects and Anomalies
- Distinguishing Between Minor Wear and Major Structural Issues
- Collaborating with Engineers and Experts for Detailed Analysis

#### **VIII. Confirming Inspection Outcomes**

- Evaluating Inspection Data Accuracy
- Documentation and Report Generation
- Client Communication and Presentation of Findings

#### **IX. Best Practices and Tips**

- Optimizing Drone Settings for Various Conditions
- Enhancing Data Accuracy through Calibration
- Troubleshooting Common Issues During Inspections

#### **X. Q&A Session**

- Addressing Participants' Questions and Concerns
- Sharing Additional Resources and References
- Closing Remarks and Thanking the Participants

<p><b>Training resources used</b></p>	<div> </div> <ul style="list-style-type: none"> <li>● Drone used for flight practical's - Drone Mini 2</li> <li>● Simulators for piloting skills – Real flight and DJI Simulator</li> <li>● Waypoint flight planning – Map Pilot Pro</li> <li>● Data Processing – Webodm and Reality Capture</li> <li>● Analysis – QGIS &amp; Reality Capture</li> <li>● Hardware teaching Aid- Fixed wing drone and DJI M100 Matrice</li> </ul>
<p><b>Approaches and methods used</b></p>	<p>The training was very interactive with short lectures and more hands-on sessions such as preflight checks on actual drones, maintenance routines, and flight planning. All participants were practically engaged and got a feel of flying a drone.</p> <p>One of the effective approaches used was to group the participants in pairs and provide different slots for hands-on sessions.</p>