

# Drones: Revolutionizing Mining & Exploration Sector

## What is a Drone Survey?

A drone survey uses unmanned aerial vehicles (UAVs), to capture data and imagery of a specific area. Drones equipped with various sensors like high-resolution cameras, LiDAR (Light Detection and Ranging), and multispectral cameras fly pre-programmed routes, collecting data that is then processed to create detailed 2D maps, 3D models, and other valuable insights.



## Workflow of a Drone Survey:

Conducting a drone survey typically involves several key steps to ensure effective data collection and analysis. Here's a generalized workflow for a drone survey:

### Project Planning:

**Define Goals:** Identify what data you need (e.g., stockpile volumes, 3D models for blast planning).

**Flight Planning:** Drone pilots consider factors like airspace restrictions, weather conditions, and flight path optimization to ensure a safe and efficient survey.

**Permitting:** Depending on the location and airspace regulations, obtaining necessary permits from aviation authorities might be required.

### Pre-Flight Checklist:

**Pre-flight Inspection:** Check the drone and its components thoroughly for any signs of damage or malfunction.

**Assess Weather Conditions:** Ensure that weather conditions are suitable for safe drone operations.

**Verify Airspace Restrictions:** Check for any airspace restrictions or flight hazards in the survey area.

### Data Acquisition:

**Deployment:** The drone equipped with appropriate sensors (e.g., high-resolution cameras, LiDAR) takes flight along the pre-programmed path.

**Data Collection:** Sensors capture vast amounts of data points, including high-resolution images and laser measurements, depending on the mission.

### **Data Processing:**

Drone data processing is the process of transforming raw data captured by drones into usable and informative outputs. This data can be captured in various forms, including high-resolution images, LiDAR scans, and more.

**Data Download:** Captured flight data is downloaded from the drone's storage.

### **For Image-Based Surveys (Photogrammetry):**

Software, such as Agisoft, processes the images, stitches them together to create high-resolution orthomosaics (geographically accurate maps), generates 3D models, and produces accurate Digital Elevation Models (DEMs).

### **For LiDAR Surveys:**

LiDAR data captures distance information using laser pulses. LiDAR processing software converts this data into 3D point clouds, dense collections of points with X, Y, and Z coordinates, representing the scanned environment. These point clouds undergo noise reduction and filtering processes. Subsequently, the refined data is utilized to generate highly accurate Digital Elevation Models (DEMs) and Digital Surface Models (DSMs), facilitating precise terrain analysis of the surveyed area.

### **Data Analysis and Deliverables:**

Analyses the processed data to extract relevant information related to the survey objectives. Look for patterns or anomalies in the data that may provide valuable insights for decision-making.

**3D Models:** Visualize stockpiles, mine pits, and terrain for better planning and volume calculations.

**Volume Measurements:** Accurately estimate stockpile volumes to optimize material management and logistics.

**Blast Hole Planning:** 3D models aid in designing safer and more efficient blasting operations

**Change Detection:** Monitoring construction progress or tracking environmental changes.

## **Why Drone Surveys are Crucial:**

Drone surveys offer significant advantages over traditional methods:



1. **Speed and Efficiency:** Data collection is significantly faster than ground-based surveys, reducing downtime and overall project costs.
2. **Safety:** Drones can access dangerous or difficult-to-reach areas, minimizing risk to personnel.
3. **Accuracy:** High-resolution data enables detailed analysis and precise measurements.
4. **Cost-Effectiveness:** Drone surveys are often cheaper than traditional methods, especially for large or complex sites.
5. **Improved Decision-Making:** The acquired data provides valuable insights for optimizing mining operations, exploration efforts, and resource management.
6. **Improved Monitoring and Inspection:** Regular drone surveys can be used to monitor blast sites, track stockpile volumes, identify potential hazards, and ensure regulatory compliance.

## Drone in Exploration Sector:

**Identify Potential Zones:** Drones can quickly capture high-resolution aerial imagery of vast areas, allowing geologists to identify potential mineral deposits and areas with specific geological features. This data can be uploaded to a mapping platform to visualize potential mining targets and plan exploration activities more efficiently.

**3D Terrain Mapping:** Drone LiDAR (Light Detection and Ranging) surveys can generate detailed 3D models of the terrain, revealing subtle features that might be missed in traditional surveys. This information helps geologists understand the geological structure and plan exploration drilling more effectively.

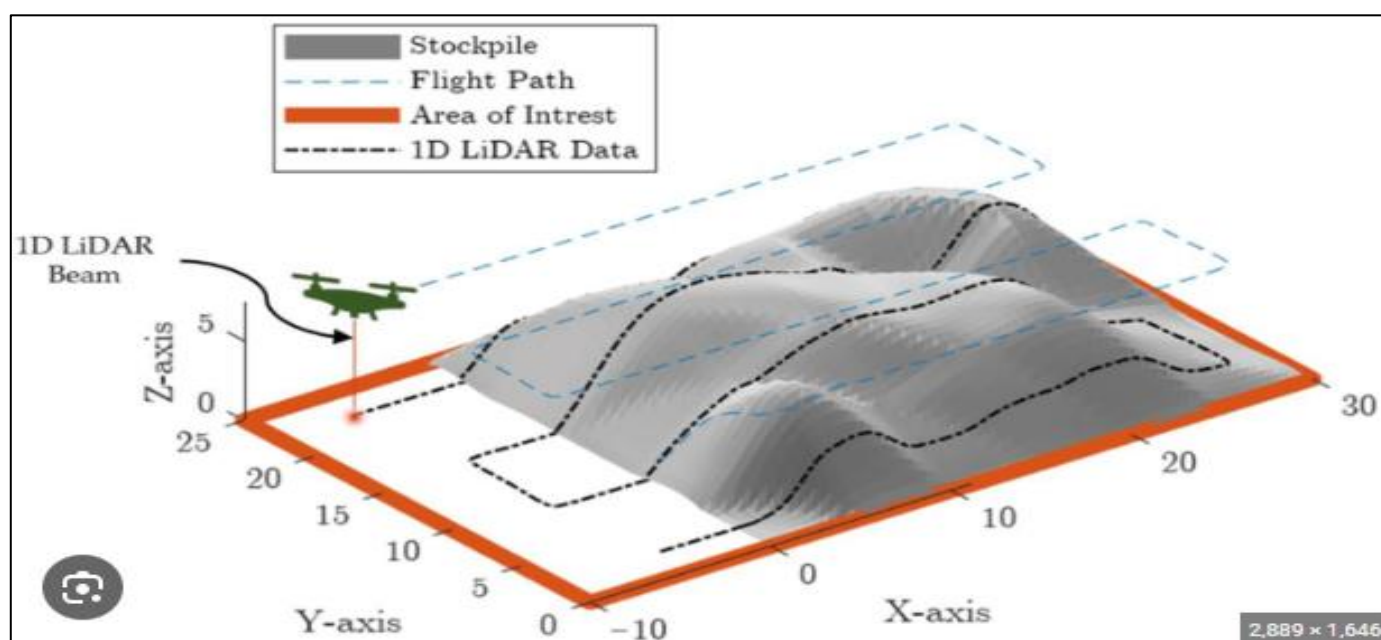
**Advanced Sensor Applications:** Drones can be equipped with various sensors for specific purposes can detect mineral deposits, like hyperspectral cameras can identify specific minerals based on their unique spectral signatures.

## Drone in Mining Sector:

### Mine Development and Operations:

**Site Planning:** Aerial surveying and mapping are very clumsy and time-consuming activities that need regular implementation by the mining industry. With high-quality drones surveys data can create accurate topographic maps this data can be integrated into the mapping platform to develop detailed mine plans, optimize haul routes, and calculate the amount of material to be extracted.

**Stockpile Management:** Managing stockpiles may be time-consuming but is necessary for safety. Drones can help in stockpile volume calculation efficiently by capturing the discrepancies in stockpiles by accurately calculating the volume of the exact shape.

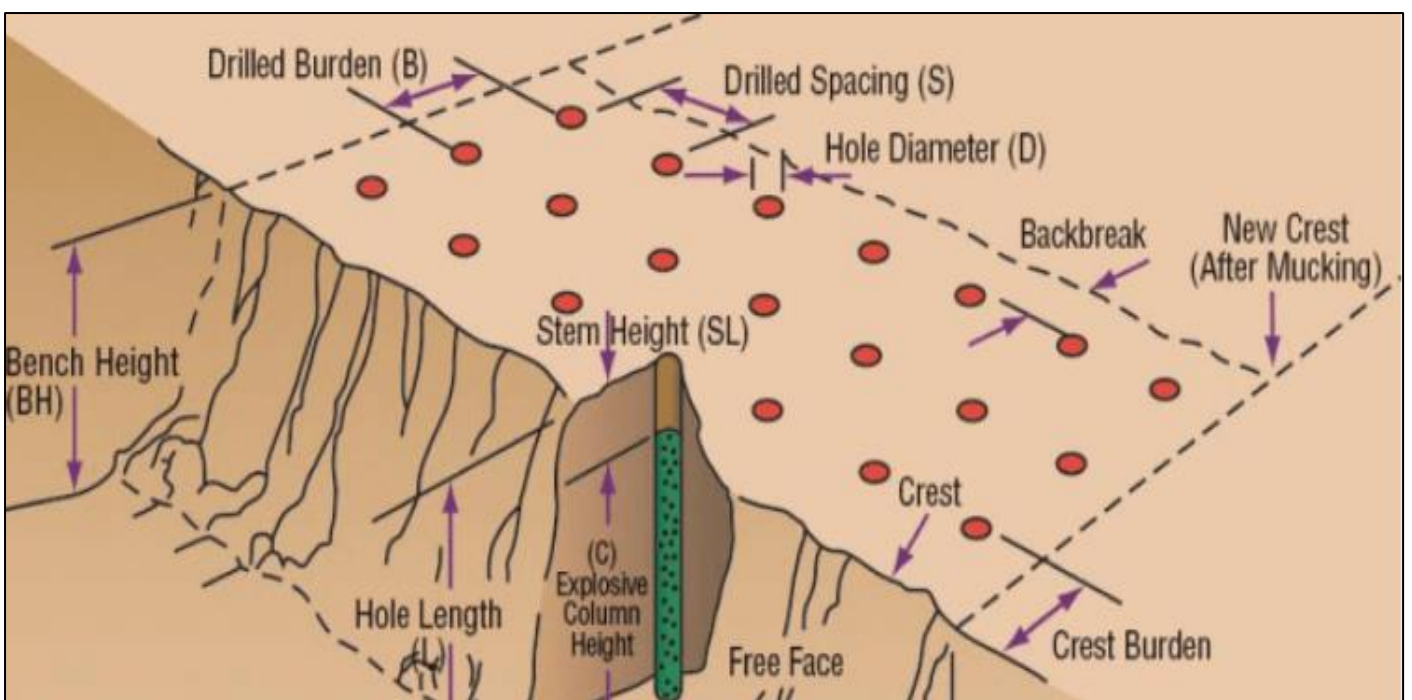


**Safer Monitoring:** Regular drone surveys can monitor the stability of slopes and identify potential hazards like cracks, rock falls, gas-leaks, dust explosions, high humidity, and floods that affects the worker's safety. This information can be track over time and take necessary actions to ensure worker safety. Drone survey photos can accurately click pictures and check road widths and windrow heights and ensure they meet efficiency and safety requirements.

**Real-time Tracking and Monitoring:** Drones can be used to monitor active mining operations in real-time, tracking equipment movement and identifying any potential issues. This data can improve operational efficiency and ensure regulatory compliance.



**Blast Optimization:** Drones can be utilized to map blast zones both before and after detonation, thereby furnishing valuable data for blast optimization and ensuring safety. Additionally, drone surveys can be employed to assess post-blast fragmentation and strategically plan subsequent blasting activities, thus aiding in waste reduction and enhancing overall production efficiency.



## Reclamation:

**Monitoring Progress:** Drone surveys can be used to track the progress of reclamation efforts, such as monitoring revegetation or identifying areas requiring further work.

**Volume Measurements for Reclamation Materials:** Similar to stockpile volume calculations, drones can be used to measure the volume of materials used for reclamation, ensuring adherence to regulations.

