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Royal Government of Bhutan
Ministry of Energy and Natural Resources
Department of Geology and Mines

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5th August 2025

NOTIFICATION

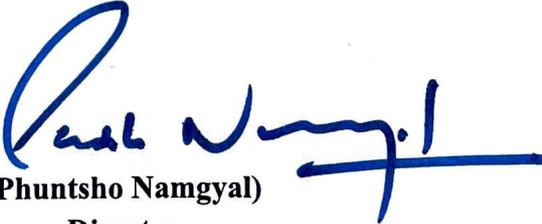
Sub: Adoption of SOP for the use and handling of drones for monitoring and field assessments, 2025

The Mining Division under the Department of Geology and Mines, is pleased to notify that the **Standard Operating Procedure (SOP) for the Use and Handling of Drones for Monitoring and Field Assessments** has been formally adopted and shall be effective from **5th August 2025**.

The SOP has been developed to ensure the **safe, efficient, and regulated use of drones** for departmental purposes such as mine inspection, surface monitoring, stockpile evaluation, and environmental assessments. It outlines clear guidance on drone deployment, pre- and post-flight checks, data handling, operator responsibilities, safety protocols, and compliance with national regulations.

All divisions and field offices are hereby instructed to **strictly adhere to the SOP** when operating drones under the department's mandate. Any drone-related activities carried out outside the provisions of the SOP shall be considered non-compliant.

The SOP document is available in digital format and may be accessed through the Ministry's website, <https://www.moenr.gov.bt>


(Phuntsho Namgyal)
Director

Copy to:

1. Hon'ble Minister, MoENR, Thimphu, for kind information;
2. Dasho Secretary, MoENR, Thimphu, for kind information;
3. Chief Engineer, MPCD,DGM, for information and necessary action; and
4. Chief Engineer, MD,DGM for information and necessary action.



Standard Operating Procedure (SOP) for use and handling of drones for monitoring and field assessments



**Department of Geology & Mines
Ministry of Energy and Natural Resource
Royal Government of Bhutan**

August 2025

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Abbreviations

- SOP: Standard Operating Procedure
- UAV: Unmanned Aerial Vehicle (Drone).
- DGM: Department of Geology and Mines
- BCAA: Bhutan Civil Aviation Authority
- GSD: Ground Sample Distance (image resolution).
- VLOS: Visual Line of Sight.
- BLOS: Beyond Visual Line of Sight
- FPV : First Person View

Definitions

- **Drone/UAV:** a type of aircraft that operates without a human pilot on board, controlled either remotely or autonomously by onboard systems.
- **Drone Operational Permit:** official authorization issued by a competent authority (BCAA) that allows an individual or organization to legally operate a drone within a defined scope, location, and time frame, under specified conditions.
- **Approving Authority:** Chief Engineer, Mining Division who will approve the issuance of the drone.
- **Issuer:** person authorized by the department and responsible for issuing drone after approval from approving authority.



1. Background

The DGM is responsible for the sustainable development and regulation of Bhutan's mineral resources, including issuing mining leases, monitoring compliance, and ensuring rehabilitation of mined areas. Facing challenges like environmental protection and regulatory gaps, the DGM is embracing digital systems and modern technologies such as drones or UAVs.

Drones offer significant advantages by providing high-resolution, real-time aerial data, which enhances operational efficiency, safety, and decision-making. They reduce time, labor, and costs by complementing traditional methods, minimize human risk in hazardous areas, and provide live situational awareness. Specifically in mining, drones will be used for 3D mapping, stockpile evaluation, environmental monitoring, and ensuring compliance with the Mines & Mineral Management Act 1995 and its regulations. This will support scientific mining, sustainable development, and environmental stewardship. To ensure their safe and compliant operation, a Standard Operating Procedure (SOP) is being established for the DGM's use, handling, issuance, and maintenance of these drones.

2. Scope of this SOP

This SOP applies to all drones procured by and under the custody of the Mining Division under the Department of Geology and Mines (DGM). It governs the operation, maintenance, and issuance of these drones for compliance monitoring purposes, specifically encompassing, but not limited to, mine surveying, environmental monitoring, and stockpile management. The scope includes all types of drones, such as multicopter and fixed-wing Unmanned Aerial Vehicles (UAVs), and ensures adherence to all national regulations.

3. Objectives of this SOP

This SOP aims to achieve the following:

- **Ensure Compliance and Safety:** Guarantee the safe and compliant use of drones by adhering to regulations set by the BCAA and other relevant agencies.
- **Standardize Operations:** Establish clear procedures for the handling, maintenance, and issuance of drones within the department.
- **Maintain Data Integrity:** Implement standardized log sheets to ensure accurate record-keeping for auditing, reporting, and continuous improvement, while also safeguarding the quality, accuracy, and confidentiality of all collected aerial data.
- **Enhance Efficiency:** Leverage drone technology for efficient data collection, site inspections, monitoring, and informed decision-making in mining and geoscientific activities.



- **Promote Professionalism:** Provide a uniform framework for all pre-flight, in-flight, and post-flight operations, ensuring consistency, accountability, and professionalism among drone operators.

4. Drone Operational Permits

Before any flight operations of drones, Certified Drone Operator shall seek approval for operation of UAV in the airspace of Bhutan by filling required forms as prescribed by BCAA. The concerned operator shall fly drones only after getting the drone operation permit.

5. Ensuring Safe operations of Drones

5.1. Pre-Flight Checklist

The following are the checklist to be followed by the drone operator before every flight operations:

- 5.1.1. Calibrate sensors (e.g., LiDAR, thermal cameras) as per manufacturer guidelines.
- 5.1.2. Check weather conditions
- 5.1.3. Check GPS signal
- 5.1.4. Set Return-To-Home (RTH) point for the drone
- 5.1.5. Check propeller integrity
- 5.1.6. Verify batteries are fully charged
- 5.1.7. Adjust monitor brightness
- 5.1.8. Check RTH altitude
- 5.1.9. Take of area safe for flight
- 5.1.10. Take notice of the people and objects around you
- 5.1.11. Check flight app for errors
- 5.1.12. Drone camera is operational
- 5.1.13. Remove Gimbal Cover

5.2. Flight Operations

During flight operations, the following checklist shall be followed by the operator:

- 5.2.1. Operate drones within Visual Line of Sight (VLOS) at all times
- 5.2.2. Fly only in areas permitted by the BCAA and other relevant agencies.
- 5.2.3. Monitor drone performance and abort missions if technical issues arise.
- 5.2.4. Record flight details, including duration, area covered, and data collected.
- 5.2.5. Avoid flying over people, vehicles, or machinery.
- 5.2.6. Adhere to local flight altitude and distance regulations.



- 5.2.7. Pause and assess if signal interference or anomalies are detected.
- 5.2.8. Capture all required data and footage for mission objectives.
- 5.2.9. Safely land and power down the drone.

5.3. Post-Flight Procedures

After successful operation of the flight, the operator shall:

- 5.3.1. Inspect the drone for damage or wear.
- 5.3.2. Download and store data securely for processing (e.g., orthophotos, 3D models).
- 5.3.3. Complete the Flight Log Sheet (Appendix A).
- 5.3.4. Submit the aerial data to the Head, Mining Division.
- 5.3.5. The Head, Mining Division shall retain the data in the central data repository.
- 5.3.6. Remove and charge batteries.
- 5.3.7. Transfer and back up flight data and media files to the central data repository.

6. Issuance and Return of Drones

6.1. Requisition and issuance of drone

- 6.1.1. Submit a duly filled requisition form as per Appendix D of this SoP to the Head, Mining Division.
- 6.1.2. The Head Mining shall verify the competency of the drone operator and the intended objective of the flight mission prior to issuance of the drone.
- 6.1.3. Approval shall be granted within 48 hours if all criteria are met.
- 6.1.4. Drones are then issued with a signed issuance form, detailing the serial number and accessories, after checking Appendix E of this SoP.



6.2. Return of Drones

- 6.2.1. The drone operators must return the issued drones within 24 hours post-mission unless extended approval is granted.
- 6.2.2. During return, the issuer shall inspect the drone and accessories in line with the checklist prescribed under Appendix E of this SoP.
- 6.2.3. Clean dust and debris from vents and cameras.
- 6.2.4. If there is dysfunctionality and damages in the drones and its accessories upon return, the drone operator shall justify the reasons for dysfunctionality and damages in the form Appendix A(remarks) for log and maintenance.
- 6.2.5. If there is any major accident during a flight mission, the operator shall submit the incident report during return of drones as prescribed in the form Appendix C of this SoP.



7. Drone Handling and Maintenance

7.1. Storage and Transportation

The issuer shall:

- 7.1.1. Store drones in a cool, dry, and secure environment to prevent damage.
- 7.1.2. The drones shall be kept in a storage cabinet with two locks in the Mining Division's workspace.
- 7.1.3. One of the keys shall be kept with the Chief Engineer, Mining Division and other with the Drone Issuer.
- 7.1.4. Padded cases shall be used for transportation to protect sensors and cameras.
- 7.1.5. Ensure batteries are stored at 50-60% charge to prolong lifespan.

7.2. Routine Maintenance

The issuer shall:

- 7.2.1. Inspect the drones after every flight mission.
- 7.2.2. Check propellers, motors, cameras, and sensors for wear or damage.
- 7.2.3. Update firmware and software regularly.
- 7.2.4. Perform firmware checks monthly.
- 7.2.5. Log all maintenance activities in the Maintenance Log Sheet (Appendix B).



7.3. Repair and maintenance

The issuer shall allow only the authorized service providers for repair and maintenance of drones.

8. Aerial Data

8.1. Data Repository

- 8.1.1. The data from drones shall be tagged and stored in the Mining Division's Data Repository.
- 8.1.2. Data Repository shall be maintained in the form of digital external hard drive.
- 8.1.3. The aerial data shall be stored in the Data Repository for a minimum period of five years.
- 8.1.4. The data obtained shall be under proprietary rights of the department.

8.2. Standardization, Quality, and Usability of Aerial data

To ensure standardization, quality, and usability of aerial data, the following data product specifications shall apply in survey:

- 8.2.1. Orthophotos: Resolution not less than 5 cm GSD; georeferenced in Bhutan National Grid.
- 8.2.2. 3D Models / DEMs: Vertical accuracy within ± 10 cm; file format: LAS/LAZ or GeoTIFF.
- 8.2.3. Video Footage: Minimum resolution of 4K; saved in MP4 format.
- 8.2.4. Metadata: Each dataset must include date, operator name, flight location coordinates, sensor type, and flight altitude.
- 8.2.5. File Naming Convention: Use standardized format e.g., [Date]/[Location]/[MissionType].ext for consistent archival.
- 8.2.6. Data Formats: Deliverables to be in open and widely accepted formats: GeoTIFF, LAS/LAZ, JPG, MP4, or SHP.



9. Regulatory Compliance

All drone operations shall comply with:

- 9.1. BCAA drone operation guidelines
- 9.2. Relevant permits from BICMA for aerial survey
- 9.3. Local permissions from landowners, if required
- 9.4. Environment clearance in sensitive or protected zones, if required.

10. Log Sheets and Record Keeping

10.1. Flight Log Sheet

The issuer shall maintain a flight log sheet in the Appendix A of this SoP.

10.2. Maintenance Log Sheet

The issuer shall maintain a maintenance log sheet in the Appendix B of this SoP.

10.3. Incident Log Sheet

In case of any major accident, the operator shall maintain an incident log sheet in the Appendix C of this SoP and report to the issuer upon return of the drones.

11. Safety and Emergency Procedures

11.1. Safety Protocols

- 11.1.1. Maintain VLOS unless approved for beyond-line-of-sight operations.
- 11.1.2. Avoid flying over personnel or heavy machinery.
- 11.1.3. Use geofencing and altitude restrictions to ensure compliance with BCAA, UAS Regulations 2017.
- 11.1.4. Ensure all pilots are trained in emergency procedures.
- 11.1.5. Only certified operators may fly drones.
- 11.1.6. Maintain a safe takeoff and landing zone.
- 11.1.7. Avoid operations during adverse weather conditions.
- 11.1.8. Carry out emergency landing procedures if needed.
- 11.1.9. Incidents or crashes must be reported within 12 hours.

11.2. Emergency Response

- 11.2.1. In case of a crash, secure the area and report to the Approving Authority.
- 11.2.2. Log incidents in the Incident Log Sheet (Appendix C).

11.3. Review and Updates

11.3.1. This SOP shall be reviewed biannually or upon any major change in operational procedures or regulations

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Appendix A: Flight Log Sheet

Date	Operator Name	Drone Serial No.	Flight Location with Coordinates	Purpose	Duration (min)	Data Collected	Remarks

Appendix B: Maintenance Log Sheet

Date	Drone Serial No.	Maintenance Performed	Technician Name	Expenditure Incurred	Remarks

Appendix C: Sample Incident Log Sheet

Date	Drone Serial No.	Incident Description	Location with Coordinates	Actions Taken	Reported To



DRONE REQUISITION FORM

Name of Division/Department/Agency:

Drone Information

- a. Drone model:
- b. Number of drone:
- c. Additional equipment:

Flight details

Date of flight		Places	Purpose
From	To		

Drone operator details

- a. Name & Designation:
- b. Contact/Email:

Requisition by:	Signature: Name: Designation: Date:
Approved by:	Signature: Name: Designation: Date:
Issued by:	Signature Name Designation Date:



(Attachments: The following documents shall be attached with this form)**

1. Approved Note Sheet for conducting the study/purpose (*copy*).
2. Drone Operator's Certificate/Competency documents for operation of the drone (*copy*).
3. Flight approval from BCAA (*copy*).

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