Drone Surveying in Mining Training Course

Professional Development Training Course Outline

Category	General Training	**Duration**	10 Days
Base Fee	$6,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

This comprehensive training course is engineered to equip mining professionals, surveyors, and drone pilots with the definitive expertise required to deploy Enterprise UAV (Unmanned Aerial Vehicle) solutions across complex mining environments. By integrating high-resolution aerial photogrammetry, LiDAR (Light Detection and Ranging), and real-time kinematic (RTK/PPK) positioning, participants will master the end-to-end workflow of transforming raw aerial data into highly accurate, actionable spatial intelligence. Drone Surveying in Mining Training Course bridges the gap between raw aviation mechanics and advanced mining analytics, ensuring compliance with strict global aviation frameworks and mine safety regulations.

This curriculum delves deeply into cutting-edge software ecosystems, enabling operators to execute automated mission planning, perform complex 3D point cloud classification, and generate precise Digital Terrain Models (DTMs). Beyond mere data collection, the syllabus emphasizes the extraction of critical analytics such as pit wall stability mapping, stockpile inventory audits, and haul road optimization vectors. Ultimately, this course empowers organizations to significantly reduce survey turnaround times, eliminate personnel exposure to high-risk mining zones, and drive data-driven operational efficiency.

Programme Curriculum

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Course Duration

5 days

Course Objectives

1. Deploy Enterprise UAV Systems.
2. Execute High-Precision RTK/PPK Workflows
3. Automate Volumetric Stockpile Audits.
4. Generate High-Density LiDAR Point Clouds.
5. Conduct Pit Wall Stability Assessments.
6. Optimize Haul Road Analytics.
7. Master Multi-Sensor Imagery Data
8. Implement Automated Mission Planning
9. Enforce Mine Safety & Regulatory Compliance
10. Streamline 3D Mine Modeling Platforms.
11. Conduct End-to-End Photogrammetric Processing.
12. Manage Big Data & Cloud Infrastructure
13. Mitigate Environmental and Blast Impact

Target Audience

- Mine Surveyors and Geomatics Engineers.
- Mining Engineers and Pit Superintendents.
- Geotechnical and Tailings Storage Facility (TSF) Engineers.
- Drone Pilots and UAV Operators
- Exploration Geologists.
- Environmental Compliance Officers
- Mine Safety and Health Managers.
- Operations Directors and Mine Managers.

Course Modules

Module 1: Introduction to Mine Drone Hardware & Sensor Selection

- Comparative analysis of Multi-rotor vs. Fixed-Wing vs. VTOL drone platforms for mining scales.
- Understanding sensor payloads.
- LiDAR sensor selection criteria
- Battery management infrastructure, field charging stations, and intrinsically safe equipment practices.
- Payload calibration routines.
- *Case Study:* Transitioning a large-scale open-pit gold mine from manual surveying to a VTOL fleet, reducing survey times by **75%**.

Module 2: Georeferencing Accuracy: GCPs, RTK, and PPK Frameworks

- Establishing a highly accurate Ground Control Point (GCP) network using traditional GNSS base and rovers.
- The mechanics of RTK (Real-Time Kinematic) drone flights and continuous correction data links.
- PPK (Post-Processed Kinematic) processing workflows
- Analyzing coordinate reference systems (CRS), local mining grids, and geoid model transformations.
- Evaluating checkpoint residuals to validate horizontal and vertical root-mean-square errors (RMSE).
- *Case Study:* Executing a PPK flight over an iron ore mine with zero ground access, achieving a vertical accuracy profile within **3 centimeters**.

Module 3: Mission Planning & Terrain-Aware Flight Execution

- Design of automated flight grids.
- Configuring 3D terrain awareness utilizing existing coarse digital elevation models to maintain constant altitude.
- Advanced corridor mapping strategies for linear mine assets like conveyor belts, pipelines, and power lines.
- BVLOS (Beyond Visual Line of Sight) mission parameters and emergency fail-safe protocol integration.
- Pre-flight checklist automation
- *Case Study:* Designing a terrain-following flight path over a deep copper pit with a **400-meter** elevation delta to maintain consistent Ground Sampling Distance (GSD).

Module 4: Photogrammetry Processing Essentials

- Image quality control filters
- The math of alignment
- Generating dense 3D point clouds from matched stereo-imagery pairs.
- Orthomosaic stitching parameters.
- Export configurations: Geotiff, LAS/LAZ, DXF, and OBJ formatting standards for cross-platform utility.
- *Case Study:* Processing a high-density 5,000-image dataset of an active quarry using cloud clusters in under **4 hours**.

Module 5: Volumetric Quantification & Stockpile Management

- Drawing precise base surfaces.
- Calculating cut-and-fill volumes, stockpile capacities, and remaining pit volume dynamics.
- Applying material bulk density factors to convert raw volumes into verified operational tonnages.
- Automated multi-stockpile detection algorithms and temporal volume change analysis.
- Reconciling drone-derived inventory volumes with truck dispatch weight logs and plant conveyor scales.
- *Case Study:* A monthly coal mine inventory audit using drones that uncovered a **12% discrepancy** in historical manual survey calculations.

Module 6: LiDAR Data Processing & Point Cloud Classification

- Importing raw LiDAR trajectories and matching laser returns with IMU/GNSS post-processed data.
- Point cloud filtering algorithms: Ground extraction, noise removal, and building/vegetation isolation.
- Generating high-fidelity Digital Terrain Models (DTMs) vs. Digital Surface Models (DSMs).
- Measuring point density, penetration capabilities through canopy, and vertical structural accuracy profiles.
- Exporting classified LAS layers into specialized software engines for structural geological evaluation.

- *Case Study:* Utilizing UAV LiDAR to map a heavily vegetated tropical bauxite deposit, exposing hidden outcrop topography for exploration planning.

Module 7: Pit Wall & Slope Stability Geotechnical Analytics

- Generating high-resolution 3D mesh models of steep pit faces and highwalls.
- Extracting discontinuity parameters
- Displacement monitoring
- Automated rockfall hazard assessment and kinematic wedge failure analysis profiles.
- Integrating drone structural models into geotechnical risk assessment software suites.
- *Case Study:* Identifying an active tension crack along an open-pit highwall **48 hours** prior to a minor failure event, preserving critical haul fleet assets.

Module 8: Haul Road Design & Safety Compliance Optimization

- Mapping haul road networks to extract exact horizontal alignment and profile vectors.
- Calculating instantaneous road grades and identifying areas that violate maximum slope design specs.
- Measuring windrow/berm geometry.
- Assessing road surface roughness, drainage cross-falls, and pooling vulnerabilities via elevation profiles.
- Analyzing haul fleet rolling resistance and fuel burn cycles based on drone-mapped road conditions.
- *Case Study:* A haul road redesign based on drone metrics at a copper mine that boosted truck transit speeds by **8%** and cut fuel expenses.

Module 9: Tailings Storage Facility (TSF) Asset Inspection

- High-frequency monitoring of TSF embankment walls for deformation, cracks, and moisture seepage.
- Utilizing thermal sensors to locate anomalous water leak paths and structural insulation failures.
- Calculating beaching angles, available freeboard volumes, and remaining slurry storage capacities.
- Mapping downstream environmental zones for early warning hazard mitigation planning.
- Generating digital twins of TSF facilities for automated stakeholder compliance reporting.
- *Case Study:* Drone monitoring of a gold mine TSF that tracked a **2-centimeter** embankment bulged zone, prompting immediate preventative stabilization.

Module 10: Pre- & Post-Blast Analytics Integration

- Mapping pre-blast benches to accurately determine burden thickness and optimize explosive placement.
- Post-blast fragmentation sizing analysis using automated orthomosaic image segmentation algorithms.
- Calculating blast muckpile distribution metrics
- Assessing backbreak severity and hard-toe occurrences along the bench floor.
- Evaluating safety exclusion zones using thermal cameras to detect residual hot spots post-blast.
- *Case Study:* Optimizing explosive consumption profiles at an aggregate quarry by adjusting blast designs based on drone-derived burden models.

Module 11: Environmental Monitoring & Mine Reclamation Tracking

- Utilizing multispectral payloads to evaluate progressive vegetation health in reclaimed areas.
- Mapping acid mine drainage pathways and identifying localized soil contamination footprints via spectral signatures.
- Quantifying earth-moving volumes during progressive backfilling and topsoil distribution stages.
- Assessing erosion channel formations along waste rock dumps and designing runoff diversion infrastructure.

- Counting flora and tracking wildlife distribution dynamics across lease boundaries for environmental audits.
- *Case Study:* Generating automated quarterly compliance portfolios for a rehabilitated coal site, cutting compliance costs by **40%**.

Module 12: Underground Mine Mapping & GPS-Denied Inspection

- Deploying specialized collision-resilient drones inside underground drifts and stopes.
- Utilizing SLAM technology to navigate without GPS signals.
- Inspecting unlined ore passes, vertical shafts, and historical collapse zones remotely.
- Mapping underground blast profiles and structural convergence over time using SLAM point clouds.
- Assessing underground ventilation infrastructure status and locating structural safety hazards.
- *Case Study:* Deploying a SLAM-equipped caged drone into an inaccessible, unstable underground stope to safely map **15,000 cubic meters** of void space.

Module 13: Mine Software Integration & Downstream Workflows

- Formatting drone point clouds for seamless import into Deswik, Datamine, Micromine, and Vulcan.
- Generating automated contour lines, breaklines, and toe/crest polygons from orthomosaics.
- Updating daily active pit faces within mine planning models to keep production schedules accurate.
- Linking geospatial drone outputs into enterprise-level ArcGIS/QGIS database infrastructures.
- Managing data interoperability formats across cross-functional engineering teams.
- *Case Study:* Designing an automated pipeline that updates a mine's core master model daily with drone data, ensuring field crews always work from current maps.

Module 14: Regulatory Frameworks, Safety, and Risk Mitigation

- Navigating national Civil Aviation Authority rules regarding commercial drone licensing and operations.
- Developing comprehensive Mine Site Standard Operating Procedures for aerial operations.
- Executing formal Job Safety Analyses and managing drone risk profiles near heavy haulage fleets.
- Establishing emergency mitigation protocols for flyaways, battery fires, and mid-air collisions.
- Data privacy frameworks, security protocols for sensitive corporate assets, and storage encryption standards.
- *Case Study:* Building a compliant drone safety framework from scratch that secured a **BVLOS waiver** for a remote desert iron ore operation.

Module 15: Corporate Drone Program Scaling & ROI Analytics

- Conducting CapEx vs. OpEx evaluations for building an in-house drone crew versus hiring external contractors.
- Designing preventative maintenance schedules, fleet tracking logs, and pilot competency reviews.
- Calculating hard return-on-investment based on time savings, safety improvements, and data precision.
- Establishing centralized cloud data storage architectures to eliminate site-level data silos.
- Future-proofing operations: Preparing for AI-driven edge compute models and fully autonomous drone-in-a-box stations.
- *Case Study:* Scaling a single-drone setup into a multi-site enterprise drone operation across **four countries**, netting a **310% ROI** in year one.

Training Methodology

- Interactive lectures and presentations.

- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

Ready to enroll or request a customized program? Book online or contact us:

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