Unmanned Aerial Vehicle (UAV) Datasets: A Powerful Tool for Spillway Condition Assessments

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Following the 2017 Oroville Dam crisis in Butte County, California, spillway evaluation and the tracking of condition over time (change detection) are becoming increasingly important. UAV datasets are proving valuable by safely yielding repeatable, high resolution plan view and oblique imagery, photogrammetrically derived high density point clouds, and digital terrain models (DTMs). By integrating surveyed ground control points, these datasets can be georeferenced for ready import into analytical and design software (e.g. AutoCAD or ArcGIS). Many factors in the program design, field execution, and post-processing affect the usefulness of the product. Understanding the nature of the target features, determining the resolution and processing necessary to capture them, and devising the necessary field program are critical to success. Customized (e.g. terrain-tracking and vertical) flight paths help address surface orientation (e.g. steep cuts or spillway walls), target irregularities, topographic relief, sun angle, and blind spots. We have found that conducting precisely designed, pre-programmed, terrain tracking flights using multiple camera angles under favorable lighting produces robust datasets. These datasets facilitate condition assessment and development of follow-on mitigation/monitoring. Well-designed UAV monitoring programs greatly facilitate the tracking of features such as concrete cracking and spalling; drain functionality (through tracking of drain production over time); seepage through cracks, joints, and seals; vegetation growth in areas of concern such as cracks, joints, and drains; areas of repeat maintenance; slab offsets; and adjacent areas of erosion. In addition, when derived through the outlined methods above, high density point clouds, can be used to create DTMs that are useful in assessing and tracking the condition of adjacent slopes, and areas of erosion. UAV data supplements but does not replace human observation, and like any tool it is best used judiciously. Incorporation of blind cross-check control points into the surveyed scene permits assessment of dataset accuracy and resolution.