October 8, 2017

The use of UAV and UAS (drone systems) with large dam spillway monitoring and examinations

Peter Wade (Merced Irrigation District) and David McCreary (New Age Aerial)

Abstract:

Abstract/Description*
Provide a well-written, concise synopsis not to exceed 4,000 characters, including spaces, of your proposed presentation topic that addresses key points.4000

This presentation will cover the use of UAS (drone systems) during construction and modification of the previously unlined area immediately below the gated spillway of the New Exchequer Dam in April and May, 2017. The background of the dam and reservoir will be briefly covered, along with the water conditions of early 2017 in the Sierra Mountains of North-Central California. After seeing issues with the Oroville Dam, Merced Irrigation District undertook improvements on the New Exchequer Dam gated spillway. This included UAS imaging work on the gated spillway and 1.8 miles of downstream unlined spillway to the confluence of the Merced River. An area of approximately 200 feet by 200 feet, corresponding to a volume of 8000 yd^3 of armored riprap was added just below the existing apron and cutoff wall over previously unlined bedrock. UAS and time lapse images were used before initiating work, after foundation cleaning and preparation, and again after the construction work. The UAS photographic evidence was used to make a record of the existing bedrock material removal and also document the newly added armoring material.   After the construction the spillway was operated and then UAS were again used to create a fourth photographic record to compare before and after flow in the unlined spillway. From the UAS data, a series of topographic maps were created of the site before removal, after cleaning and stripping of the foundation, and after construction, and a fourth final mission was flown after July 2017 trial flows.   The data gathered was used to estimate the volume of solids during removal, during construction, and also to estimate flow sediment transport rates. Gathered data was also found to adapt well to the creation of physical scaled models through 3D printing technology. Virtual and 3D models have proved helpful promoting visualization during PFMA discussions.

Key points will include examples of deliverables and progression of work from the UAS vendor for this service. Discussion to include data workflow from image capture in the field to processing and finally to presentation and use by the dam owner and engineers.

Technical discussion will include selection of the equipment used, camera type, image processing, and image and map resolution once processed.

Summary of findings will include the final mapping products and show how engineers are using these tools for assessment of the structure. The dam owner's future plans for site monitoring with UAS will be discussed.   These include producing virtual models for use in 3D fluid computer modeling combined with erosion sensitivity data of foundation material to estimate future erosion rates and effects of future flows.

Learning Objectives
500

Learning objectives will demonstrate real world examples of how UAS (drone systems) technology can be used supplement monitoring of dams and spillways both for O&M and for construction.   This will be scaled to interest both the novice and the experienced professional within the fields of dam safety and spillway assessment.

Methodology
Methods

Explain how you will conduct the presentation. You are challenged to be informative, creative and interactive. Provide enough detail that reviewers can clearly visualize your presentation (2000 characters).1000

This presentation is to be conducted by 2 individual presenters, both a dam owner's representative and a consultant (drone systems vendor). The dam owner will speak from his experience and perspective in the 2017 spillway assessment work (including the 2017 spillway construction work) addressing key points (cost, results, job site safety, how to contract/control work, etc.) The consultant (drone systems vendor) will speak to the specific technology used, the make/model of drones and cameras used over the project, the data flow for image processing, how this data can be used for map making, physical model making with 3D printers). The presentation will utilize a traditional PowerPoint slide show presentation, with real photos, graphics, and video gathered during the project. Hand held 3D printed models will be available for a show-and-tell of what can be done with the data-set.