RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

Inaccessible Penstock Features

Summary of USACE and Reclamation collaboration to test UAS for penstock inspections

Research Bulletin
Science and Technology Program

S&T Project 7118

This project describes ongoing collaboration between USACE and Reclamation to develop an autonomous UAS that can inspect inaccessible features in tunnels such as a penstocks and draft tubes.

Mission Issue

This project supports Reclamation's mission by helping to keep its infrastructure safe and able to perform their functions.

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Problem

Inspections are routinely conducted within a hydroelectric facility's internal features. These features include the penstock and draft tube. The penstock is a tunnel that directs water to the generator turbine and the draft tube conducts the water to the outlet on the downstream side of the turbine. Numerous tunnels, pipes and conduits convey water to reservoirs and facilities. These tunnel features range between 4 feet to 40 feet in diameter and curve at angles that inspectors cannot access without special rope access gear and training. In addition, entry into the tunnel often requires special clearances, training and other safety precautions.

Solution

Reclamation first observed the autonomous tunnel inspection UAS at a joint demonstration at Glen Canyon Dam, Arizona, in 2015. Ongoing testing of a UAS inspection platform has continued at the University of Pennsylvania and at USACE's Center Hill Dam, near Smithville, Tennessee, and a test at the Francis E. Walter Dam, near Bear Creek Township, Pennsylvania. Reclamation attended a Center Hill demonstration in the summer of 2016 and continues to provide feedback and progress reports. The completed UAS design is expected soon.

Testing a custom tunnel inspection UAS in a penstock at Center Hill Dam, Tennessee, with University of Pennsylvania researchers.

"Having the ability to conduct autonomous UAS inspections in tunnels will be safer and allow for comprehensive data collection."

Matthew Klein
Civil Engineer
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Collaborators

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More Information

https://www.usbr.gov/research/projects/detail.cfm?id=7118

Application and Results

While this work is ongoing, the results are close to being finished. Reclamation will continue to collaborate with USACE and intends on participating in a final upcoming demonstration. The value of this work is immense and is requested from all over Reclamation. Once the project is completed and the UAS is made available, it will be able to provide safely-obtained inspection documentation within Reclamation facilities.

Future Plans

Reclamation plans to attend the last demonstration of the UAS, potentially at a Reclamation facility. Once the UAS design is complete, it will be made available to USACE and Reclamation for construction and operation.

The third version of the autonomous tunnel inspection UAS.