

Using Unmanned Aerial Vehicles

Determining how Unmanned Aerial Systems (UAS) can help meet Reclamation's remote sensing data needs

Bottom Line

Reclamation and partners are using Unmanned Aerial Systems (UAS) in pilot studies to evaluate the strengths and limitations to find effective niches for using UAS to accomplish various U.S. Department of the Interior agency missions.

Better, Faster, Cheaper

Using UAS is less expensive and provides more detail in more areas than piloted aircrafts or satellites, and covers more area than land and boat surveys.

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Collaborators

- NASA
- U.S. Geological Survey
- Utah State University

Problem

Reclamation regularly uses remotely sensed data for monitoring habitat, analyzing water quality, generating topography, mapping land use/cover, classifying crops, and measuring evapotranspiration, among other applications. But, each remote sensing system has limitations—satellite imagery is useful primarily for low resolution regional surveys; manned aircrafts can be expensive and subject to weather and other delays; and traditional boat surveys provide detailed data, but cannot cover wide areas with any frequency. Unmanned aerial systems (UAS) can address some of these challenges.

Solution

UAS technology can:

- Readily provide high resolution data more cost-effectively and more frequently than boat surveys and piloted aircrafts
- Provide the ability to fly in areas considered to be too dangerous for piloted aircrafts
- Capture imagery in cloudy areas
- Capture imagery at higher resolution than satellite imagery or piloted aircrafts
- Provide real-time imagery
- Offer highly portable aircrafts that require no landing strip
- Provide aircraft safety for pilots to use

This Science and Technology Program research project is developing a community of interest within Reclamation, and partnering with other agencies to determine the potential uses of UAS to accomplish Reclamation's mission.

Reclamation researchers have developed a UAS community of interest to monitor developments in UAS technology, submit UAS research proposals, organize training workshops, and promote exploration of the potential uses of UAS within Reclamation.



The Raven launch at Aldwell Reservoir on the Elwha River, Washington.

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For example, the U.S. Geological Survey (USGS) Rocky Mountain Science Center and Reclamation have been using the “Raven” unmanned aerial vehicle to monitor shifting topography as sediments are removed from two former reservoirs at dam removal sites on the Elwha River, Washington. The Raven is 3-foot long with a 4.5-foot wingspan, hand-launched, battery-operated, and typically flies from 100 to 400 feet above the ground at a speed of about 30 miles per hour. It has an approximate flight time of 1 hour and carries a 0.5 megapixel camera (11 megapixel cameras have been successfully used as substitutes).

Application

Applications need to be mission-tested to determine whether UAS technology can provide superior results compared with current technology. There are some concerns that need to be addressed, including privacy, security, obtaining certificates of authorizations, maintaining line of site in complex areas, and training. Reclamation is working with partners to address these challenges. Possible UAS applications for Reclamation include:

- Canal monitoring
- Crop identification and yield forecasting
- Dam and levee inspections
- Emergency management response
- Estimating algae density in sewage lagoons
- Evapotranspiration estimation
- Flood hazard analysis
- Flood risk assessment
- Flow-to-habitat relations
- Habitat mapping
- Identification of canal encroachments
- Identification of flood plain encroachments
- Imaging to make ortho-rectified maps
- Integrating remote sensing and point data
- Law enforcement
- Moisture content in snow
- Monitoring dam faces for seepage
- Riparian surveillance
- River corridor change detection
- River restoration monitoring/change detection
- Root zone soil moisture estimation
- Sediment transfer
- Snow depth
- Urban/canal interface mapping
- Volume estimation
- Water spreading
- Water turbidity
- Wetlands classification

Future Plans

As interest in UAS technology continues to grow, the community of interest will start to have regular meetings, its SharePoint site will be upgraded, and more Reclamation staff will receive flight training on both the “Raven” and the “T-Hawk.”

Reclamation’s Pacific Northwest (PN) Region will make presentations to its leadership regarding the merits of UAS technology in fiscal year 2013. PN UAS pilots have identified several missions that are ready to fly once funding and Federal Aviation Administration (FAA) certificates of authorization have been obtained.

“Reclamation’s UAS community of interest now has over 50 people, from every Reclamation region including directors, group managers, information resource personnel, dam safety experts, hydraulic engineers, geographic information systems scientists, geographers, civil engineers, geologists, soil scientists, meteorologists, emergency management staff, remote sensing specialists, and information management specialists. This shows the wide-spread interest in this technology.”

Douglas Clark
Physical Scientist, Reclamation

More Information

A SharePoint site for Reclamation users:
<https://dosp/techResc/TR/TSC/UAS/Pages/default.aspx>

U.S. Geological Survey Rocky Mountain Science Center:
www.rmgsc.cr.usgs.gov/UAS/

Science and Technology Program Research Project:
www.usbr.gov/research/projects/detail.cfm?id=4926

