

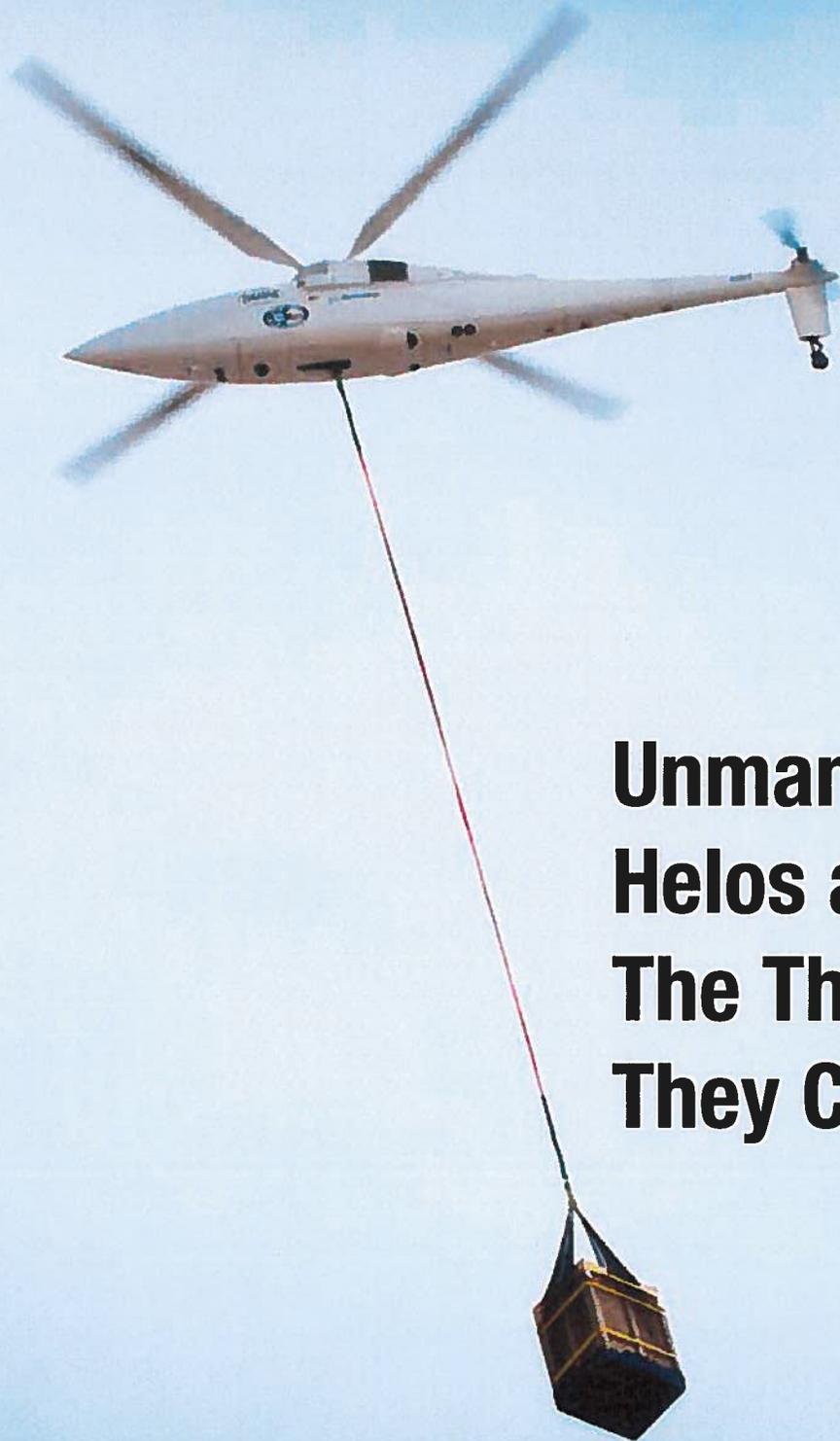
EUROPE UPDATE

RAVENS AND CRANES

ANTI-IED UPDATE

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When the Ravens met the Sandhill Cranes

USGS and USFWS Team Turns to Unmanned Aircraft to Count Wildlife

By Philip A. Owen

Sandhill cranes are large birds (up to eight feet in wingspan) that migrate from Texas to Idaho and Siberia each year, stopping at the Monte Vista National Wildlife Refuge in Colorado along the way to rest and feed.

The U.S. Fish and Wildlife Service is required to inventory the cranes as they migrate and turned to the U.S. Geological Survey to help. Cranes have traditionally been counted by either fixed-wing aircraft or scientists with binoculars, but those methods are costly, time consuming and at times can be hazardous both for the flight crews, scientists and the birds. The USGS decided to try using a bird of another type to count the cranes — the RQ-11A Raven unmanned aircraft, a small, hand-launched UAS built by California-based AeroVironment.

The USGS and USFWS biologists wanted to see if a Raven sensor package could pick up the heat signature of cranes and allow biologists to obtain an accurate count during their roosting period. The service worried the cranes might fear them, mistaking the Ravens for eagles, a major predator, and fly away.

COA for Cranes

The USGS applied for a certificate of authorization (COA) from the U.S. Federal Aviation Administration, and five months later received final approval, just after Christmas in 2010.

The COA specified that the Ravens had to remain below 400 feet, within visual line of sight of the observers and could fly from morning civil twilight (defined as a time when terrestrial objects can be clearly distinguished) to evening civil twilight. This was a cause for some concern, as the cranes are least likely to “flush,” or fly away, at night while at roost, but the Ravens weren’t cleared for nighttime operations. The COA conditions allowed just about a 30-minute timeframe between civil twilight and sunrise to launch and conduct the mission before there were too many cranes in the air for safe Raven flying.

The operation was developed by Leanne Hanson of USGS, Jim Dubovsky, a biologist with USFWS Division of Migratory Bird Management, and Floyd Truetken, manager of the Monte Vista National Wildlife Refuge. It was presented to the USGS UAS Project Office, headed by Mike Hutt out of the Rocky Mountain Geographic Science Center, in Denver. The USGS received Raven A systems from



Sandhill Cranes at the Monte Vista Refuge. All images courtesy Mark A. Bauer and Bill Christiansen.

the U.S. Army under a memorandum of agreement in early 2010 and this was their first operational mission in the National Airspace System.

After conducting two days of training, test and evaluation, the first operational flight launched at 6:36 a.m. on 23 March and flew about 800 meters (2,600 feet) to the roosting site, where two certified observers were stationed. The team was expecting the cranes to flush as they approached, but as the Raven flew over there was no reaction, and the operator noted that the cranes were clearly visible using the forward-looking thermal camera. The team conducted several more passes at varying altitudes, from 75 feet to 300 feet above ground level before returning and landing at the launch site.

The flight was a great success, and the team was able to identify individual birds without disturbing them. The flight team and scientists, who were located at different locations, met for a detailed debrief and then conducted extensive planning for the next day’s mission. The team decided to use a new modified down-looking thermal camera designed by enrGies, a small business based in Huntsville, Ala., and fly an area 600 by 400 meters (1,300 by 2,000 feet) using parallel line transects at 200 feet above ground level to cover the complete roost site.

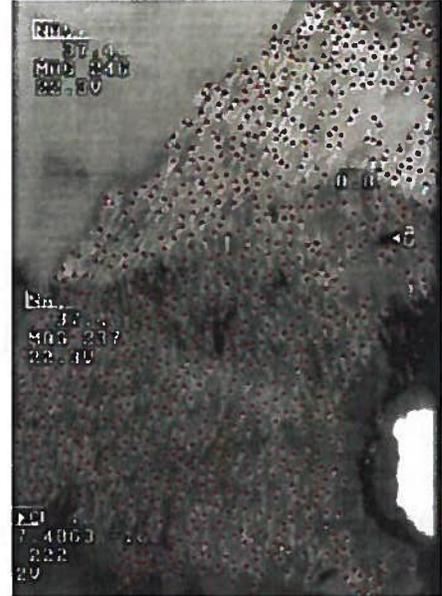


The entrance to the Monte Vista National Wildlife Refuge.

During this mission, the Raven video was displayed to the scientists on-site in Monte Vista and digitized in both a low-density stream as well as the highest density possible. The low-density stream was transmitted to enrGies' streaming server for access by others offsite, and the high-density stream was available for real-time and post-processing analysis.

In addition to this operational support, enrGies demonstrated its Bio Trakker, which consists of a modification to the Raven allowing it to locate radio-frequency tagged wildlife. The advantage of using inexpensive unmanned aircraft rather than manned aircraft for this task is significant. The Bio Trakker consists of a broad-beam antenna array, a scanning receiver, and the processing and integration to inject the received data into the Raven's existing telemetry downlink. The location of the target is identified within 100 meters and any data regarding the tagged subject, such as whether it's alive or dead, is also provided.

This additional metadata consists of location, roll, pitch, yaw, signal strength, heading and aircraft pointing angle as well as other customized platform information. Imagery and metadata are referenced to



Infrared imagery from a Raven of a Sandhill Crane roost site. The black part of the image reflects "hot" areas.

each other resulting in a smooth path to rectification and imagery mosaicking. Raven and subject locations are viewed in real time by the use of enrGies' GE Trakker software plug-in, which enables the user's existing Google Earth application to display the Raven flight path, wildlife location and any other instrumented vehicle, person or aircraft.

This common operating environment or moving map display is available either online or offline, significantly enhancing Google Earth's utility in network deprived areas. For interested scientists and researchers who are located elsewhere, a web link may be accessed via the web server supporting the imagery distribution. These applications and capabilities have significant implications across the scientific spectrum and are a great addition to the biologist and earth science mission toolkit.

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Preparing for a crane-hunting flight.

On Thursday morning, 24 March, the USGS team met at 5:30 a.m. for its operational brief. The weather was good: clear skies, eight degrees Fahrenheit and light winds. The COA Notice to Airman (NOTAM) was published, and the team was ready to fly. The team moved to the launch and recovery site and set up the Raven system in preparation for a 6:34 a.m. launch. Using FalconView mission planning software the day before, the team had set up waypoints that

established an east-west transect grid so that the entire roosting area was covered, with overlapping flight paths at an altitude of 200 feet above ground level.

After a successful launch with the nadir infrared payload, the Raven flew in its autonomous mode of flight and within 13 minutes flew all eight of its transect runs without disturbing the cranes. The team then adjusted the waypoints and flew seven more runs at higher altitudes, both 300 feet and 400 feet. The total flight lasted 24 minutes and made 13 passes over the roost. The nadir camera worked perfectly, and the Raven did not disturb the cranes. The video was processed using mosaicking software that allowed biologists to conduct a detailed count of the roosting area.

The Count and the Amount

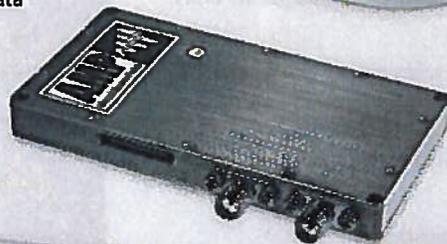
The U.S. Fish and Wildlife Service conducted ground-count surveys before the Raven flights to get an "observed" population count as well as verify the location of the cranes within their roosting area. Because the count of cranes would likely be most accurate using the near-vertical camera, the team decided to use the count from the second operational flight for this "test case." Results indicated that the USFWS ground observers counted 2,692 cranes on the area. The count from the Raven videography was 2,567, a difference of only 4.6 percent. Dave Sharp, a retired U.S. Fish and Wildlife Service biologist who has been working with the Sandhill cranes for more than 25 years, says, "I was skeptical about this process at first, but it has exceeded my wildest expectations."

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The team, with Raven.

Another biologist, when asked if Raven video could be used to validate his crane count, said it is the other way around: His count will be used to validate the Raven's, as the Raven found birds that we did not know were there.

"I would like Raven and the team to come back to my refuge next year to conduct a more extensive count, and they can come back and train anytime. I would definitely recommend them to other refuge managers and biologists," says Floyd Truetken, the refuge manager.

There was 100 percent agreement among the scientists involved that this technology will revolutionize the way wildlife counts and tracking are conducted in the future.

On to the Grizzlies

This first operational mission for the Department of the Interior (the parent organization for both USFWS and USGS) was an outstanding success across the board and set the standard for future operations.

The USGS team conducted nine flights during the week for a total of 4.8 hours of flight time without incident. The USGS Rocky Mountain Geographic Science Center is now working on applications for 10 COAs for the remainder of the year, with more requests coming in daily.

The USGS is planning on three more basic operator classes this year, of which one will be law enforcement specific. Maintaining currency and proficiency will continue to be a major hurdle; however, the team has begun working with military facilities across the country to develop memorandums of agreements to use their restricted airspace for that purpose.

The Bio Trakker system also opens the door for countless scientific missions. Richard Sojda, the branch chief at the USGS' Northern Rocky Mountain Science Center and USGS science coordinator for the Great Northern Conservation Cooperative from Bozeman, Montana, was present at the Monte Vista operation.

He has already started working on a COA to use the system to locate tagged grizzly bears in remote areas of Montana.

Philip A. Owen is a retired U.S. Army CW4 Black Hawk pilot who currently works for MCR Aerodyne as the primary UAS instructor for the Department of the Interior after six years as a U.S. Army Raven instructor. He has taught Raven courses or conducted operations in Iraq, Afghanistan, Germany, Korea, Lebanon and throughout the United States.

For More Information:

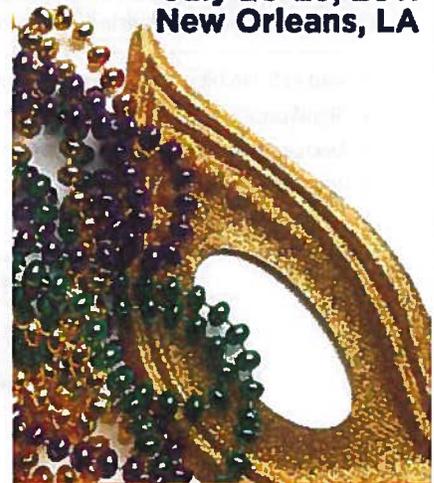
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