



Motus Automated Telemetry Network

Application of Motus on Military Lands

Department of Defense
Partners in Flight

Our Mission

Providing expertise on the management and conservation of birds and their habitats to sustain and enhance the military mission



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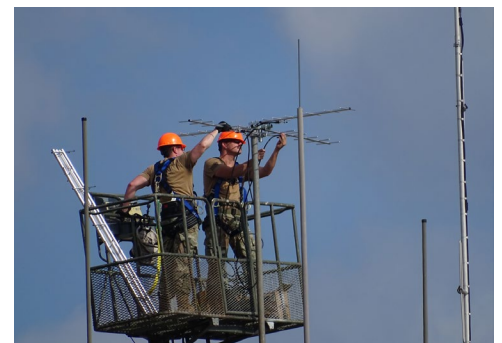
Overview

The Motus Wildlife Tracking System (www.motus.org) is a collaborative network of partners that use automated VHF radio-telemetry stations to track mobile wildlife species. Motus elevates traditional radio-telemetry studies by allowing for the integration of local, regional, and global-scale studies. Automated radio-tracking studies can reduce costs by replacing labor-intensive manual tracking (often confined to a local scale) with passive tracking using stationary receivers. At larger spatial scales, the Motus network provides an alternative to Global Positioning System (GPS) tags and geolocators to track individual bird migration. Motus projects can be much more cost-effective than satellite GPS tags that transmit location data (e.g., over the cellular network), allow for the tracking of species as small as warblers and even Monarch butterflies, detect and monitor movements of bat species, and provide an advantage that individuals do not have to be recaptured to retrieve data as is the case with geolocators or less expensive archival GPS tags. Projects can be designed with a variety of goals, such as determining locations and durations of migratory stopovers, quantifying spatial use (including habitat use) over various spatial scales, determining migratory connectivity patterns, estimating site fidelity, quantifying juvenile dispersal, estimating survival, assessing flight departure decision information, relating weather patterns with migration, and estimating flight speeds during migration.

Motus Station Setups

A Motus station, although variable in specifics, is comprised of a receiver, antennae (tuned to either 166.380 or 434 MHz tag frequencies) mounted to a mast

or an existing structure, a power source (either solar/battery or plugged into an outlet) and coaxial cables connecting the antennae and receiver. A series of nodes, essentially small antennae that communicate with the base station, can be deployed to obtain finer-scale data. Motus stations do not transmit data, they record tag ID with time-stamped detections and signal strength of tag transmissions. Tags are similar to standard VHF radio-tags but are coded to represent individual tag IDs on the same frequency. Maximum detection distances vary with topography and vegetation conditions, and a well-placed tower can detect tags up to 10 miles away. Towers should be placed in areas where interference is minimized, and line-of-sight coverage is maximized. VHF signal does not travel through hills or structures and antennae should be placed above the tree line if possible.



KS Air National Guard installing Motus on McConnell AFB. Photo by Mike Jungen

Contributions to Conservation Infrastructure

Motus projects have the potential to inform regional or range-wide conservation and management efforts for threatened, endangered, or mission-sensitive species that occur on Department of Defense (DoD) lands.



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Currently, approximately 1,700 Motus receivers are in operation as potential detection locations for tags. The Motus network enables data integration across over 400 currently implemented projects throughout the ranges of over 250 species that have been tagged to date, many of which lack full annual cycle ecology information needed to inform effective conservation actions.

Applications within DoD

Motus stations and Motus tagging projects can be implemented in DoD wildlife studies and are an effective means to increase collaboration with DoD installations and conservation partners such as non-governmental organizations, federal and state agencies, and universities. The Motus network can benefit DoD while also contributing environmental stewardship toward numerous existing and future Motus studies on migratory species of conservation concern that use DoD lands and areas adjacent to installations. Motus towers installed by DoD within heavily used migratory flyways could be especially beneficial in areas with gaps in Motus coverage. Motus data could improve DoD wildlife conservation actions and help meet Integrated Natural Resources Management Plan objectives. Furthermore, Motus projects could be designed to better inform flight missions by obtaining information regarding Bird/Wildlife Aircraft Strike Hazard (BASH) risks.

Accessing, Sharing, and Managing Motus data

Tag detection data are stored internally on receiver hardware, with options available to upload over the cellular network, via Wi-Fi/Bluetooth, or

manually to the Motus database, which is maintained by Birds Canada in partnership with collaborating researchers and organizations. Most of these uploaded data are publicly available, as this network is meant to enable range-wide conservation efforts and data sharing to improve knowledge of migration patterns and full annual cycle requirements of birds and other wildlife that cross study site boundaries and borders. However, if deemed necessary, there is an option to opt out of data-sharing and hide detection data from public view and other researchers.

Barriers to Overcome

Obtaining approval to install a Motus station on DoD lands often begins with reaching out to frequency and real property managers to determine if placing receivers/antennae to detect 166.380 and/or 434 MHz frequencies is permissible. Deploying transmitters on 166.380 MHz also requires notifying USFWS Frequency Manager John Wolfe (john_wolfe@fws.gov), while the license for 434 is held by the manufacturer, Cellular Tracking Technology. Signal interference may inhibit Motus detections but is avoided by testing at potential tower locations. Following detection data analysis, steps may be necessary to assess likelihood of false positive detections. Towers can cost ~\$8K to \$25K per station, depending on setup details, and often require some amount of maintenance, troubleshooting, and support (typically \$3-5k per year). The most expensive component is the mast, but there are many alternatives available such as existing communications arrays, range towers, small building masts, or utility poles. Delays from approval through the installation process may occur but should become less frequent as more installations acquire Motus towers.