A REMOVABLE CAR-TOP ANTENNA SYSTEM FOR RADIO-TRACKING BIRDS

By Olin E. Bray, Richard E. Johnson, and A. Lawrence Kolz

While radio-tracking Starlings (*Sturnus vulgaris*), Red-winged Blackbirds (*Agelaius phoeniceus*), and Common Grackles (*Quiscalus quiscula*) in several states, we followed birds that moved up to 30 miles from their roosts. We therefore needed a mobile antenna system that would permit quick readings of signal direction, but we could not make permanent alterations to our vehicles. Mobile antenna units described by Marshall and Kupa (1963), Proud (1969), and Anderson and DeMoor (1971) were inappropriate. They required either that a hole be cut in the roof of the vehicle or that the researcher get out of the vehicle and erect the antenna at each monitoring point. We therefore developed a system that is attached temporarily by car-top carrier bars and is operated by the driver from inside the vehicle.

SYSTEM DESIGN AND CONSTRUCTION

The antenna system (Figs. 1 and 2) was constructed in the following manner:

1. Two car-top carrier bars (Item A; Montgomery Ward & Co., Inc.,[1] Denver, Colorado) that clamp to the rain gutter of a vehicle were joined by bolting a 20 x 18 x 0.25-inch piece of steel (B) in the middle between them.

2. Item C, a 4 x 1.25 x 0.125-inch piece of iron bent in the middle at a 90° angle, was bolted to the bolt stud for the handle of a 0.25-inch angle head drill attachment (Item D; Sears, Roebuck and Co., Chicago, Illinois). Item D was anchored in the center of B by bolting C to B.

3. An antenna mast support (E) was made with four pieces of 12 x 0.5-inch threaded rod and two 1.25-inch Fafnir flange bearings with locking collars (Fafnir Bearing Co., New Britain, Connecticut). The two bearings were secured 5 inches apart with nuts. Item E was placed over D and bolted to B.

4. An antenna mast (F) was made with a 34-inch piece of 1.25-inch outside diameter (OD) aluminum tubing, a 0.625-inch socket, and two 1-inch-long spacers cut from 1.125-inch OD and 1-inch OD aluminum tubing. The drive end of the socket was lathed down to fit inside the 1.0-inch spacer. The two spacers (the smaller one inside the larger one) and the socket were inserted in one end of the aluminum tubing and secured with two countersunk machine screws. The socket end of the mast was passed through the bearings of E and placed over the nut on the shaft of D. The mast was locked into place with the collars of the bearings.

[1]Reference to trade names does not imply Government endorsement of commercial products.

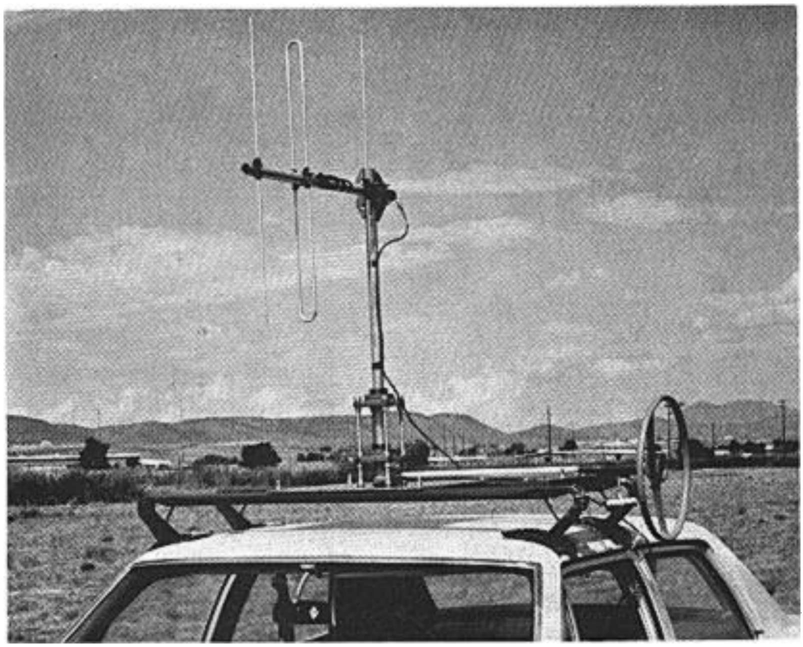

FIGURE 1. Removable car-top antenna system for radio-tracking birds.

5. A drive-shaft (G) was made with a 26-inch piece of 1-inch OD aluminum tubing and a 0.625-inch socket. The drive end of the socket was lathed down to fit inside the aluminum tubing and was secured with a bolt. The socket was placed over the nut on the shaft of D.

6. A drive-shaft support (H) was made with an 18 x 2 x 1-inch piece of channel iron and a 7-inch piece of 1-inch inside diameter (ID) black iron pipe. The pipe was welded in the middle of the channel iron so that one end of the pipe extended 0.25 inch beyond the inside edge. The pipe of item H was slipped over G, and the channel iron was bolted to the two carrier bars (A) 2.5 inches from the end of A on the driver's side. (If there is friction when G is turned, H should be raised with spacers or lowered by grinding down the channel iron where it overlaps A.)

7. An 0.875-inch OD, 11-inch-long automobile steering shaft (I) with a 15-inch steering wheel (J) attached was slipped inside G. A hole was drilled through I and G so that it was flush with the inside end of the pipe on H. A cotter-key was inserted in the hole to keep G and I in place. The antenna mast (F) now rotated when J was turned.

8. A drive-shaft lock (K) was made with a 1-inch ID eye-bolt and a 4-inch piece of 1-inch OD aluminum tubing. The tubing was

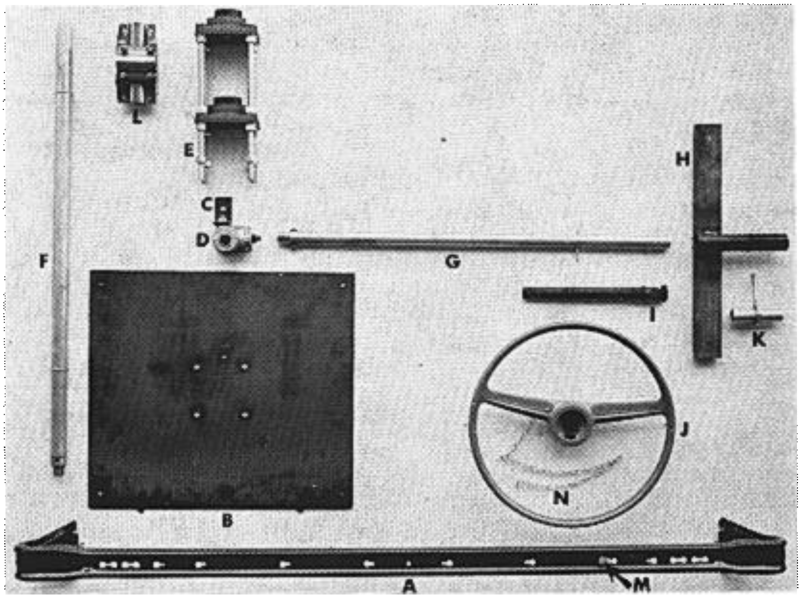

FIGURE 2. Parts used in constructing car-top antenna system. Letters correspond with construction details in text.

centered in the eye of the eye-bolt and secured with metal screws to serve as a handle. Item K was then screwed into a threaded hole drilled in the underside of the pipe of H (2.25 inches from the channel iron). Tightening K against G immobilized the antenna mast (F).

9. A 164-MHz, three-element yagi antenna was attached to F with a television antenna bracket (L). The distance between the bottom of the antenna elements and the car top should be at least one-fourth the wave length of the frequency of the telemetry system.

10. A 14-foot coaxial antenna lead was attached to the antenna and taped to F. It was then passed through a plastic cable clamp (M), which was bolted to A, placed through the rear side window, and attached to the receiver inside the vehicle.

11. A 22-inch piece of light chain (N) was bolted to A and J. The chain allowed the mast to be turned only three turns and thus prevented the antenna lead from becoming tightly twisted around the antenna mast.

DISCUSSION

With this antenna system, a Model LA 11-5 receiver (AVM Instrument Company, Champaign, Illinois), and transmitters built by personnel of this laboratory's Bioelectronics Unit, the reception distance is usually 1 to 3 miles for instrumented birds on the ground and 1 to 7 miles for birds in trees. Flying birds have been monitored from as far as 15 miles. Reception distances are greatest when birds are monitored from elevated points because this minimizes interference from vegetation and hills between the bird and the antenna.

Reception distances with the roof-top antenna are about 10 percent greater than those obtained with the same antenna held by an observer standing on the ground. However, because monitoring with a hand-held yagi requires the observer to get out of the vehicle at every monitoring point, an even greater advantage of our system is the speed (and convenience) with which readings can be taken by a single driver-tracker. Because the assembly uses car-top carrier bars, it can be mounted in a few minutes on any standard car or truck without making any alterations to the vehicle. The cost of the system is moderate; the parts shown in Figure 2 cost about $80.

Our studies do not require plotting the azimuth of signals because we work in agricultural areas where we can get close enough to an instrumented bird to determine its exact location. However, our system could be modified so that signal bearings could be read in degrees and plotted for triangulation.

SUMMARY

An inexpensive, vehicle-mounted antenna system has been developed for fast and convenient radio-tracking of birds. The system, which does not require alterations to the vehicle, permits an observer to monitor instrumented birds from inside the vehicle and gives about 10 percent greater reception distances than a hand-held antenna.

LITERATURE CITED

ANDERSON, F., AND P. P. DEMOOR. 1971. A system for radio-tracking monkeys in dense bush and forest. *J. Wildl. Manage.*, **35**: 636-643.

MARSHALL, W. H., AND J. J. KUPA. 1963. Development of radio-telemetry techniques for ruffed grouse studies. *Trans. N. Am. Wildl. Nat. Resour. Conf.*, **28**: 443-456.

PROUD, J. F. 1969. Wild turkey studies in New York by radio-telemetry. *New York Fish and Game J.*, **16**: 46-83.

U. S. Fish and Wildlife Service, Wildlife Research Center, Denver, Colorado 80225. Received 20 July 1974, accepted 7 October 1974.