
A Snap-on Transmitter Attachment for Whooping Cranes and Other Long-legged Birds

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ABSTRACT

*I developed a snap-on transmitter leg band that can be attached to Whooping Cranes (*Grus americana*) within a few seconds. The application described here was temporary and related to a specific reintroduction technique. However, future improvements could result in more permanent transmitter attachments useful in study of cranes and other long-legged birds.*

INTRODUCTION

Ability to track birds by radiotelemetry is a necessary part of many research studies and management projects. Shape and weight of the transmitter package, type of attachment, and position on the animal may have long-term effects on behavior and survival. Methods of restraining the bird and time required for transmitter attachment pose shorter-term concerns but may affect subsequent survival or ability to perform needed behaviors during the period from immediately after attachment until acclimation to the device is complete.

A unique challenge arose in reintroduction of an eastern migratory population of Whooping Cranes (*Grus americana*). This reintroduction began in 2001 by captive-rearing of crane chicks with puppets and costumed personnel (Horwich 1989, Urbanek and Bookhout 1992, Nagendran et al. 1996, Ellis et al. 2000), training the birds to follow ultralight aircraft (Lishman et al. 1997, Duff et al. 2001), and then leading them on their first autumn migration from the northern release area in central

Wisconsin to a protected winter release site on the west-central Gulf Coast of Florida (Urbanek et al. 2010). Although the cranes were normally under complete human control prior to their eventual release on the wintering grounds, project staff required the ability to track them during migration to recover occasional birds which dropped out of ultralight-led flight formation and then needed to be retrieved during the migration segments. In summers 2001 - 2002, I fitted recently fledged juveniles with permanent transmitters on conventional legband mounts during the training period in Wisconsin. Trainers reported that these birds were lethargic and unwilling to follow aircraft for several days after attachment of transmitters and recommended that reduced handling might result in less interruption of the training process. A new goal then became the development of a temporary transmitter mount which could be attached with minimal handling time. This paper describes the unit that was developed and its subsequent evaluation in the field.

METHODS

The snap-on transmitter evolved from several preceding steps in band development and banding needs. In 1984, study of the Sandhill Crane (*Grus canadensis*) population at Seney National Wildlife Refuge, Michigan's upper peninsula, began as part of evaluation of that area for possible future reintroduction of Whooping Cranes. Objectives of that study required identification of individual birds and extensive tracking. I captured most birds by

rocket-netting (Urbanek et al. 1991) and individually marked them with combinations of red, white, and green bands stacked above the tibiotarsal joint. I fabricated bands from Gravoply I ABS engraving plastic (Gravograph, Inc., Duluth, GA) based on recommendations by Hoffman (1985). Transmitter deployment began in 1985, and a suitable leg band on which to mount transmitters was needed.

I developed a design that was modified from a secondary method of attachment described by Melvin et al. (1983). That method consisted of affixing the transmitter package (i.e., transmitter circuitry and battery within potting and mounted on a plastic base plate) to a single band with plastic pipe cement after the latter had been placed on the crane. The main flaw with this arrangement was breakage or creation of a lengthwise stress fracture when the single 7.6-cm-high band was opened. I solved this problem by using two wrap-around bands, rather than just one, on which to cement the transmitter package. Fabrication of the two bands was similar to the small color bands noted above but each was lengthened to 3.8 cm and precisely ground to fit together. An additional advantage of this type of band/transmitter attachment was that two color bands supporting the transmitter provided many more possible individual identification codes than a single color band.

The plastic bands were formed by rolling plastic strips that had been heated to 125° C around a conduit built up to the specified diameter with masking tape. Finishing to exact size and rounding sharp edges was accomplished with a grinding wheel and dremel rotary tool (Dremel, Racine, WI).

In 2001 I used a larger version (22.9-mm inside diameter) of the same bands on Whooping Cranes. I fabricated semi-circular cross-section plastic base plates to fit the outer surface of these bands and supplied them to manufacturers for building and affixing the transmitters. VHF transmitters were single Li-battery units with 21.6-cm-long antenna (Model A3590, Advanced Telemetry Systems, Isanti, MN). Satellite transmitters were PTTs

(platform transmitter terminals, Model PTT-100 30-g SiV, Microwave Telemetry, Columbia, MD). Each transmitter package when mounted on the bands produced a streamlined unit weighing approximately 53 g.

Although this transmitter mount worked quite well, crane caretakers proposed that the time taken for juvenile Whooping Cranes to adjust to the new transmitters interfered with their training to follow ultralight aircraft and suggested that this behavior might be partially corrected if handling time were reduced. Handling time already included veterinary examination and collection of various medical samples. I therefore developed the snap-on transmitter (Fig. 1), which assumed the same shape and weight of the earlier transmitters permanently mounted on wrap-around bands (described above). Details of materials and construction appear in Appendix A. The snap-on transmitter did not require application and setting of cement and could be attached in seconds. Permanent wrap-around mounts required 10 min of holding the bird; however, other processing steps required during banding were also accomplished simultaneously with setting of the cement. The snap-on transmitter had two significant advantages in addition to simple, rapid attachment: (1) it was reusable without modification, and (2) battery life of the permanent transmitters, attached after the birds completed their first (ultralight-led) migration, was conserved for the more critical need after birds were released and beyond control of caretakers. Another minor advantage relevant in a few special situations was that the bird did not have to be picked up to attach the transmitter.

I removed all snap-on transmitters intact after completion of the ultralight-led migrations. Removal required use of a pry tool fabricated from a 2.5 × 12.7 strip of 0.25-mm thick brass sheet metal to unlock the band. A 3-mm-wide lip oriented at a right angle ran the lengthwise edge of the tool. After removal, I cleaned each unit, deactivated the transmitter by taping on a magnet, stored all in a waterproof container, and refrigerated until redeployment.

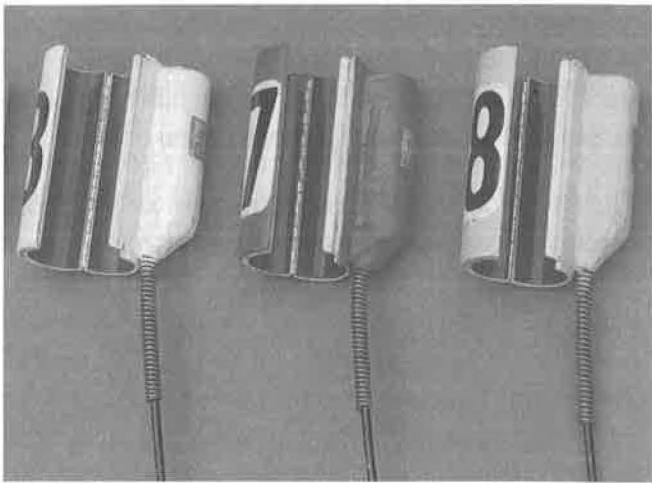


Fig. 1. Snap-on legband transmitters ready for deployment on Whooping Cranes.

RESULTS

I attached transmitters simply and without complications in all cases ($n = 102$), 2003 - 2008. Attachment consisted of snapping the open band with mounted transmitter shut into locked position around the tibiotarsus of the crane (Fig. 2). Time required to do this on a bird already in hand was 5 - 10 seconds.

Removal occurred after ultralight-led migration was completed. Band removal was more time-consuming than attachment but still rapid, requiring 10 -15 seconds. Positioning of the leg so that the lock could be accessed adequately with the pry tool was more difficult than when the band was initially affixed. Great care was necessary to avoid breaking the locking plate during removal of the band, whereas, initial attachment of the band had been more straightforward.

Twenty-two different snap-on transmitters were deployed on 102 Whooping Cranes banded during six years. During this period, 11,985 transmitter-days were accumulated (mean attachment time per transmitter per year = 117.5 days, $SE = 2.5$). Transmitter retention from initial deployment through completion of migration was 100%. No significant deterioration or damage to the bands occurred during the first four years. During the remaining two years, problems occurred on only four bands, all noted at removal: One band had

unlocked but remained closed and attached to the bird. On two bands, the locking plate fractured during unlocking, and on another the end of the locking plate cracked while unlocking. The number of accumulated days of deployment was not greater for damaged bands (mean = 455, $SE = 55$, $n = 4$) than for undamaged bands (mean = 565, $SE = 37$, $n = 18$).

Minor antenna damage not related to the band occurred on all transmitters during each year. This damage was usually related to loss or cracking of insulation over the antenna wire and was repaired with heat-shrink tubing before units were reused.



Fig. 2. Snap-on transmitter on tibiotarsus of juvenile Whooping Crane.

DISCUSSION

Retention of transmitters was complete during the six years of study. Attaching the snap-on transmitter was simple and rapid for all birds. Removal was also rapid but required experience and care to avoid breaking the locking mechanism. Except for four units requiring minor repairs in the fifth and sixth years of the study, all units were later reused without modification, except for minor antenna repair after removal and cleaning.

This method of transmitter attachment could also be used with little modification, other than reduction in band size, for most other crane species (Gruidae). The design is also appropriate for most of the larger Ciconiiformes (herons, ibises,

spoonbills, and storks). Application would be for temporary deployment, especially related to birds released from captivity, specialized reintroduction methods, or any birds that would be monitored and then recaptured.

A main disadvantage of the snap-on transmitter was the mechanics of construction. Exact precision in fabricating and assembling the small parts was necessary. Although Gravoply plastic provided a very workable material, skill and experience in forming and assembling the components were required. Time needed to construct each unit was approximately six hours, not including time for setting of cement and adhesives.

These snap-on bands are only temporary because they contain movable parts which might cause the bands to unlock after trauma or wear, and they contain a metal hinge which will deteriorate over time. Durability of the unit was also not tested with repeated exposure to water and subsequent freezing. Unsealed gaps between movable parts in the locking mechanism and hinge would likely result in breakage under such conditions.

Transmitters mounted on wrap-around bands provide the most streamlined design, least weight, and least surface area of options currently available for permanent attachment on cranes. Their retention rate, when properly fabricated and attached, is excellent, lasting 8 to more than 20 years (R. Urbanek, pers. obs.). The only other transmitter mounting system commonly in use is flange-type bands, which consist of two band halves with lateral flanges that attach together by rivets. The transmitter is affixed permanently by the manufacturer to one of the band halves. These units can be attached more quickly, amounting to approximately five minutes less holding time per bird required for attaching permanently glued wrap-around bands. However, the effects, which may be long-term and subtle, of this less streamlined shape and greater surface area on crane behavior (and survival) have not been critically evaluated. This is especially true in cold climates, where ice accumulation may occur or where transmitter

package shape may interfere with hock bending and result in reduced thermoregulation in the leg and freezing of toes. The latter problem has been noted in Sandhill Cranes (R. Urbanek, pers. obs.).

The two types of permanent transmitter leg bands in current use on cranes address two different priorities; i.e., the short-term benefit of reducing banding time by a few minutes versus the long-term benefit of minimizing the size and surface area of the transmitter mount that the bird will carry for the remainder of its life. The snap-on design described here is currently only for temporary applications, and its uses are limited to certain projects with special requirements. However, if improved materials and mechanical improvements to retain precision while reducing time of construction can be developed, this design might lead to future applications that incorporate the positive features of both currently existing types of permanent transmitter mounts.

ACKNOWLEDGMENTS

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LITERATURE CITED

- Duff, J.W., W.A. Lishman, D.A. Clark, G.F. Gee, and D.H. Ellis. 2001. Results of the first ultralight-led Sandhill Crane migration in eastern North America. *Proceedings of the North American Crane Workshop* 8:109-114.
- Ellis, D.H., G.F. Gee, S.G. Hereford, G.H. Olsen, T.D. Chisolm, J.M. Nicolich, K.A. Sullivan, N.J. Thomas, M. Nagendran, and J.S. Hatfield. 2000. Post-release survival of hand-reared and parent-reared Mississippi Sandhill Cranes. *Condor* 102:104-112.
- Hoffman, R.H. 1985. An evaluation of banding Sandhill Cranes with colored leg bands. *North American Bird Bander* 10:46-49.

Horwich, R. H. 1989. Use of surrogate parental models and age periods in a successful release of hand-reared Sandhill Cranes. *Zoo Biology* 8:379-390.

Lishman, W.A., T.L. Teets, J.W. Duff, W.J.L. Sladen, G.G. Shire, K.M. Goolsby, W.A. Bezner Kerr, and R.P. Urbanek. 1997. A reintroduction technique for migratory birds: leading Canada Geese and isolation-reared Sandhill Cranes with ultralight aircraft. *Proceedings of the North American Crane Workshop* 7:96-104.

Melvin, S.M., R.C. Drewien, S.A. Temple, and E.G. Bizeau. 1983. Leg-band attachment of radio transmitters for large birds. *Wildlife Society Bulletin* 11:282-285.

Nagendran, M., R.P. Urbanek, and D.H. Ellis. 1996. Special techniques, part D: reintroduction techniques. Pp. 231-240 in D.H. Ellis, G.F. Gee, and C.M. Mirande (eds.), *Cranes: their biology, husbandry, and conservation*, National

Biological Service, Washington, DC, and International Crane Foundation, Baraboo, WI.

Urbanek, R.P., J.L. McMullen, and T.A. Bookhout. 1991. Rocket-netting Greater Sandhill Cranes on their breeding grounds at Seney National Wildlife Refuge. Pp. 241-245 in J.T. Harris (ed.), *Proceedings of the 1987 International Crane Workshop*, Qiqihar, Heilongjiang Province, China. International Crane Foundation, Baraboo, WI.

Urbanek, R.P., and T.A. Bookhout. 1992. Development of an isolation-rearing/gentle release procedure for reintroducing migratory cranes. *Proceedings of the North American Crane Workshop* 6:120-130.

Urbanek, R.P., L.E.A. Fondow, S.E. Zimorski, M.A. Wellington, and M.A. Nipper. 2010. Winter release and management of reintroduced migratory Whooping Cranes *Grus americana*. *Bird Conservation International* 20:43-54.

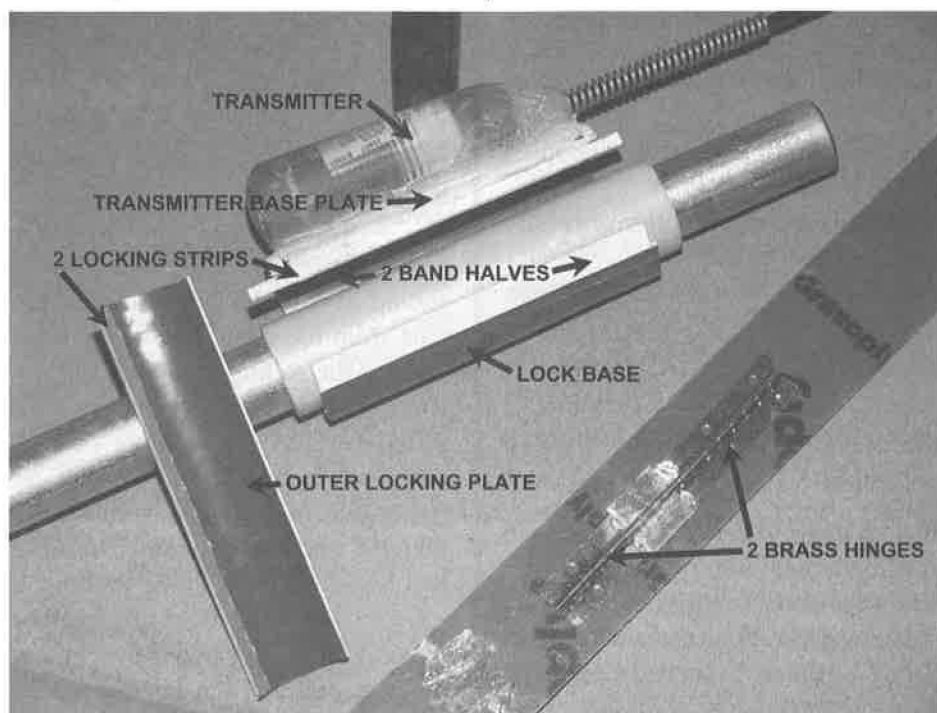


Fig. 3. Component parts of snap-on legband transmitter for Whooping Cranes. Refer to details of assembly in Appendix A.

APPENDIX A.

Construction details of snap-on transmitter leg band. Individual parts are identified in Fig. 3. Sources of materials are indicated below if not in text.

Materials:

Gravoply 1 ABS sheet, 2-ply, 0.8 mm thick

Gravoply 1 ABS sheet, 2-ply, 1.6 mm thick

Oatey (Cleveland, OH) CPVC/PVC/ABS Cleaner

Oatey All Purpose Cement for PVC, ABS, CPVC
Hobby Lobby (Oklahoma City, OK) #471045 Brass
Hinge, 4.4 cm long

Brass strip, 6.4 mm wide, 0.4 mm thick

Goop Plumber's Contact Adhesive and Sealant
(Eclectic Products, Eugene, OR)

Transmitter mounted on PVC or ABS base plate, 0.8
mm thick

Tools:

Rolling conduits, wool gloves, hardboard oven sheets
Sharp heavy duty scissors or sheers
Dremel with following attachments: block wheel,
tapered cone, metal cutting disc, sanding disc, sanding
wheel
Grinding wheel, 15.2 cm
Vice, hammer
Files (3 sizes, fine to coarse)
Forceps (fine point), exacto-knife, fine-point long
needlenose pliers
Q-tips
Masking tape

Instructions (per transmitter):

1. Each transmitter will require two 4.4-cm-long brass hinges. Cut three knuckles off one of these hinges so that combined length of both hinges is 7.6 cm. Finish the cut end on a grinding wheel. Cut two 12.7-mm-long pieces of brass. Glue the two hinges together by affixing these two pieces of brass on top of the intersection of the two hinges with Plumber's Goop.

2. Heat and roll four different diameters of plastic cylinders:

22.9 mm (standard band diameter for Whooping Cranes) for two band halves, 1.6 mm thick

26.3 mm (standard diameter of transmitter base plate) for 1 lock base, 1.6 mm thick

27.9 mm for two locking strips, each 3.2 mm wide, 0.8 mm thick

29.5 mm for outer locking plate, 25.4 mm wide, 0.8 mm thick

Make these six pieces from plastic cut 3.5 cm long before rolling.

In steps below, allow cement to set and then remove excess before proceeding to next step.

3. Cut off the edge of the transmitter base plate straight across to remove tapered corners. Cement a locking strip to the top of the straightened base plate edge.

4. Cut and finish the band halves until they are perfectly semicircular in cross-section.

5. Mount the two band halves on a rolling conduit and temporarily use masking tape to substitute for the hinge that will be attached later.

6. Cement the transmitter base plate on top of one band half so that the base plate extends exactly 6.4 mm (combined width of two locking strips) past the edge of the band half.

7. Close the band halves on the rolling conduit. Butt the lock base against the locking tab on the base plate (attached to the other band half). Mark and cement the lock base in this position.

8. Cement a locking strip on the underside of one edge of the outer locking plate.

9. With band halves closed, fit the locking plate tightly in position over locking tab on base plate. Mark this position, open the band halves, and cement the locking plate in the marked position.

10. At this point a correction to a minor incompatibility problem with the transmitter base plate (i.e., the base plate is too short) should be made. This problem can be solved by either (a) cementing plugs on the band ends in front of the locking plate or (b) cementing a lateral extension to each end of the base plate so that the base plate will be as high as the completed band.

11. With the grinding wheel, grind down the edges of the brass strips holding the hinges together so that they are flush with the edges of the (now one-piece) 7.6-cm-long hinge.

12. Cut dried Goop along hinge knuckles with exacto-knife. Roughen and clean the underside of the hinge.

13. After a minimum of 12 hours, preferably more, close the band halves on the rolling conduit. They should now be locked in place. Remove the masking tape from the other side of the band halves. Tape the ends to the rolling conduit tightly with masking tape. Roughen the area where the hinge will be fastened with a sand wheel. Apply Plumber's Goop to the underside of the hinge and carefully place and securely push (repeatedly over about 15 minutes) the hinge in position with the needlenose pliers until it is exactly in position and pushed as close to the band halves as possible.

14. After eight or more hours, apply another coat of Plumber's Goop to cover the entire outside of the hinge as well as fill in gaps among the various pieces of plastic that are of different diameters but exposed on the outside of the band.

15. After 12 or more hours, dremel protruding plastic edges and excess Plumber's Goop from the outside of the band. Cut dried Goop along knuckles with exacto-knife.

16. Grind down ends of band to 7.9 cm final length. Round edges with dremel.

17. Unit is ready for painting. Preferred paint is non-toxic, high viscosity, lightfast acrylic (Liquitex Artist Materials, Piscataway, NJ)