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ABSTRACT

EPRI has developed the Bird Strike Indicator (BSI) to monitor bird collisions with power lines and guy wires. Such technology has utility in Alaska, especially in some coastal locations, where large flocks of birds are known to migrate. Bird species such as the threatened spectacled eider (*Somateria fischeri*) and Steller's eider (*Polysticta stelleri*) have been known to collide with structures such as power lines and tower guys. Quantifying bird strikes, especially in remote locations, is extremely difficult, especially when loss of carcasses to scavengers confounds results. The ability to immediately respond to a bird strike in real time allows for robust monitoring of bird mortality due to collision with wires.

The BSI system consists of sensors, which are attached to guy wires or power lines, and a base station that receives electronic "strike" signals radioed from the sensors. The base station can be programmed to notify (via telephone or pager) a person off-site if immediate carcass recovery is desired. The base station can also be linked to a secure web site so that it can be remotely accessed. Stored information on the base station can be downloaded to a remote computer via telephone modem, or if available, via the internet.

Initial testing of this technology took place in Cold Bay, Alaska where climatic conditions challenged both the durability and functionality of the BSI. The system was installed in April 2005. During the following 9 months, no bird strikes were recorded. Routine on-the-ground monitoring for feather spots, carcasses, etc, by a USFWS technician revealed no other evidence of bird strikes. However, the harsh weather conditions in Cold Bay allowed for testing and fine tuning of the BSI system under extreme conditions, such as hail, rain, snow, and winds exceeding 60 mph.

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1 PROJECT OVERVIEW

Background

In 1997 the U.S. Coast Guard (USCG) constructed a 120-foot guyed Differential Global Positioning Satellite (DGPS) tower on the Izembek National Wildlife Refuge (Refuge) located at Cold Bay, Alaska. In November 2004 the DGPS tower was upgraded to include the addition of 6 guy wires. The tower presently has four levels of guy wires for a total of 15 wires (Photo 1). The lattice tower is lighted with two continuous red lights.

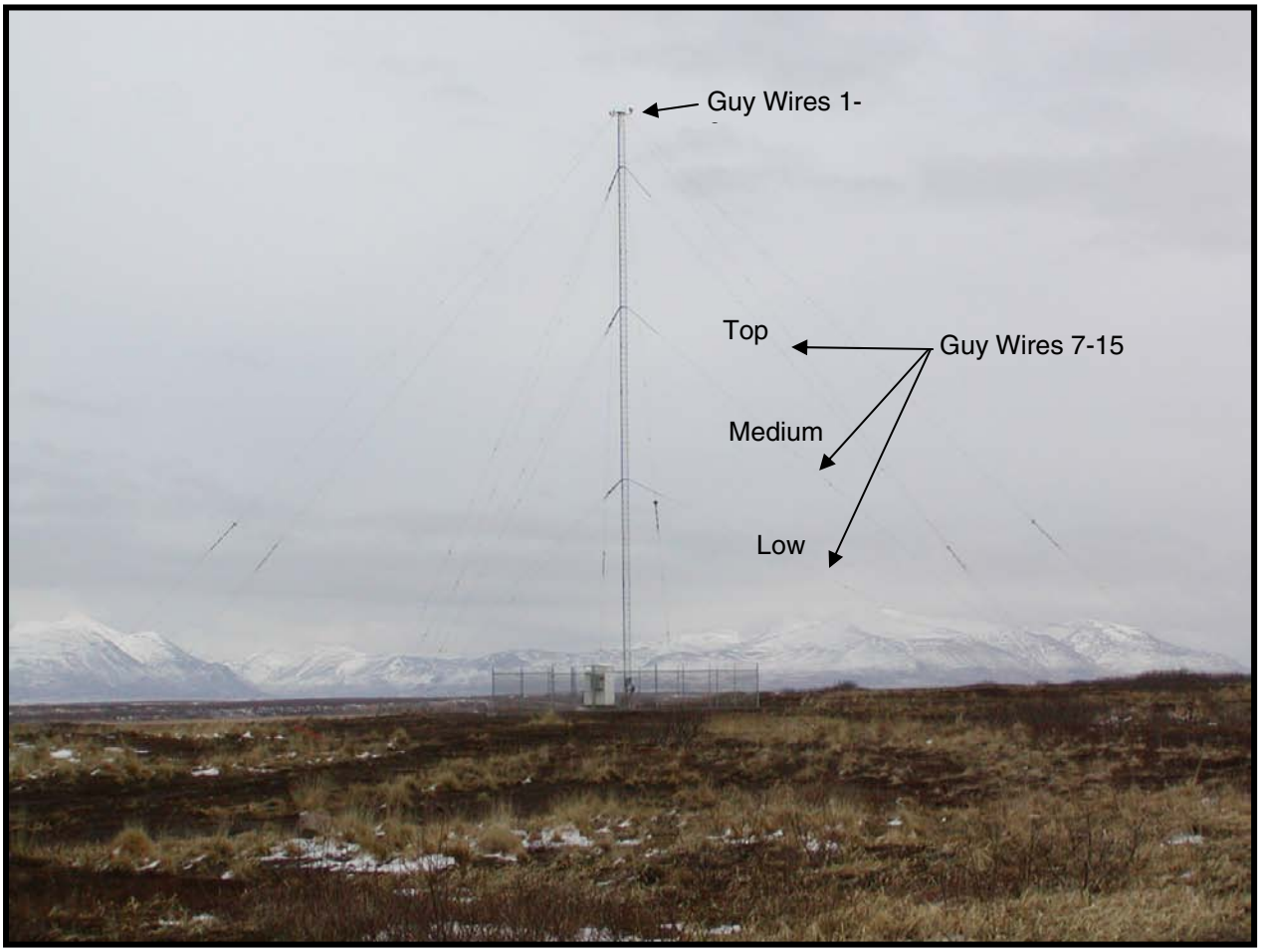

Photo 1. DGPS Tower with Four Levels of Guy Wires, 15 Total

Bird strikes have been documented at other tower facilities within the Refuge. These events occurred primarily at night during storm events in late fall, winter and early spring (USFWS 1995). These included collisions where birds appeared to be attracted to lights. Because there was concern the federally threatened Steller's eider (*Polysticta stelleri*) might collide with tower guy wires, the tower was sited in an area expected to have a lower collision probability (USFWS 1995). Additionally, all guy wires were marked with yellow Bird Flight Diverters (BFDs)

spaced at 15-foot intervals (**Error! Reference source not found.**) to make the wires more visible to birds.

Photo 2. Bird Flight Diverter on Tower Guy Wire

Because Refuge strikes have occurred at night and in inclement weather, the BFDs may not be effective in reducing collisions. For this reason a study was developed to gauge their effectiveness. The study design uses Bird Strike Indicators (BSIs) to remotely monitor and report collisions with the guy wires. These devices monitor the wires and report any strikes to a base station located at the site. The base station stores strike information, which is remotely downloaded via the Internet. For a detailed description of the BSI and its technical components, refer to the Electric Power Research Institute (EPRI) Technical Report 1005385, *Bird Strike Indicator/Bird Activity Monitor and Field Assessment of Avian Fatalities*.

BSI Deployment

In April 2005 the DGPS tower guy wires were fitted with BSIs as part of an ongoing collision-monitoring project. The BSIs were attached to 12 of the 15 wires. When collision events are detected, information is transmitted to a base station housed in an onsite USCG fiberglass building. A Refuge technician remotely monitors the base station on a daily basis. The technician then inspects the tower site to see if bird carcasses are present.

In addition to the BSIs, a protocol was developed to have a USFWS technician independently survey the DGPS tower site on a weekly basis looking for bird carcasses. This evaluation is necessary to ensure birds are not striking wires and avoiding detection by the BSIs.

Results

Immediately after installation on April 7, 2005, numerous events were recorded by the BSI

system. These signals were compared to those from simulated bird strikes. A comparison of recorded signals to simulated bird strikes is shown in Figures 1 and 2. The recorded signals have spikes, which are not typical of bird collisions. Typical bird strikes create vibrations that slowly die down over time (see Figure 2). The recorded trigger events in Figure 1 have been determined to be weather related.

Weather is suspected due to the signal signature and because subsequent field investigations by the Refuge technician failed to detect any bird carcasses or feather spots. The tower is sited in lowland tundra with plants consisting of wet and moist graminoid and herbaceous vegetation. Any carcasses near the tower would easily be detected given the flat terrain and low vegetation. Additionally, corresponding weather events consisting of heavy rain, and sleet were recorded (pers. comm. USFWS). In response to this, the threshold for detecting a strike was remotely increased to minimize the weather related events. After making the threshold change, very few weather related events were recorded.

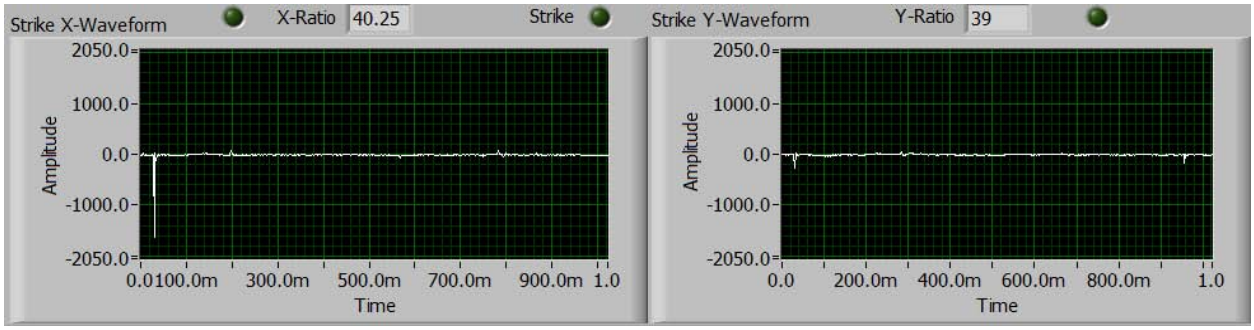

Figure 1. BSI Weather Event Screen Capture

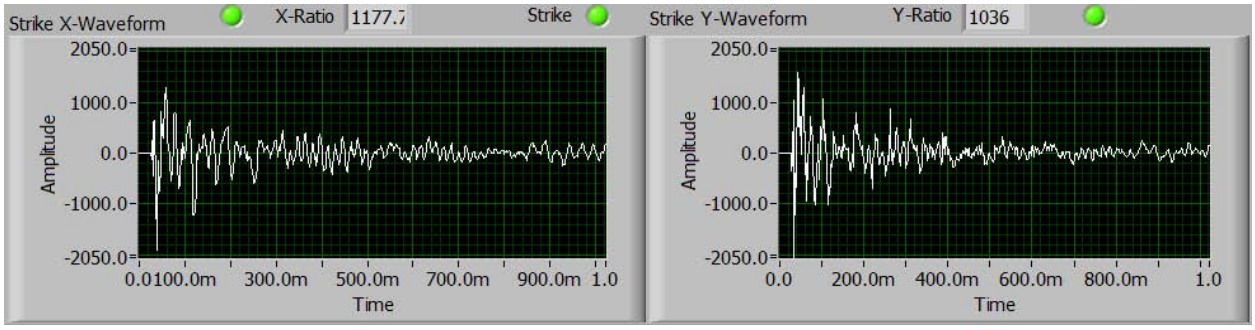

Figure 2. Simulated Refuge Bird Strike

BSI Inspection and Recalibration

Previous attempts at developing remote collision detection systems have been attempted. A system developed in 1989 encountered significant problems with sensor moisture intrusion (APLIC 1994). Cold Bay experiences frequent high winds with a maximum yearly precipitation of 45 inches and a minimum of 21 inches. On July 19, 2005, the BSIs were taken down for

inspection. Despite the wet weather conditions of Cold Bay, the monitors did not experience moisture intrusion problems during 5 months of service.

Because weather is suspected in false trigger events the BSI's firmware was modified to filter out such events. A filter was added to detect and discard strikes with a signature that goes immediately back to zero. The filter inside the BSI simply looks at the vibration data immediately after the strike is detected. A bird strike event will be more like a transient vibration that will slowly die down like the simulated bird strike signatures. New firmware was uploaded into each of the BSI.

The BSIs operate by using four D-Cell batteries each. The power consumption was designed to ensure reliable sensor operation for six months (depending on the quantity of strikes). The batteries were not replaced during the July retrofitting in order to determine how long they can last. However, spare batteries were provisioned at the base station, should they be required.

In the original BSI installation, 12 sensors were installed. Three guy wires were without sensors. During the recalibration the additional wires were fitted with BSIs. All 15 sensors were fitted with new gaskets and reinstalled on the same wire position.

BSI Monitoring & Performance

Batteries in two of the BSI sensors were replaced on October 24, 2005. In November, batteries in four sensors were replaced. One of the sensors did not come back to life after replacing the batteries. Five of the sensors with replaced batteries continue to operate as of end of February 2006. Out of the 15 installed sensors, 9 sensors are still operational. However, the battery voltage in the sensors with original battery is getting low. The sensors that are not operational are the ones with original battery and likely have low battery voltage.

Discussion

Historic collision events have occurred during the late fall, winter and early spring at other Refuge locations (USFWS 1995). From late August through early November the world's population of Pacific brandt, thousands of Canada geese, and other waterfowl congregate on the Izembek lagoon. Each fall the entire population of emperor geese also migrates through the Refuge, along with many migrating shorebirds. The BSI installation allowed for monitoring when large numbers of migrating waterfowl passed through the Refuge and during winter weather when strong winds and fog force birds to fly low. Although the BSI did monitor during this high bird use period, no confirmed bird collisions were detected by either the BSI or the independent field surveys.

It is possible bird strikes were occurring, but scavengers removed the carcasses prior to detection. On both the April 2005 and July 2005 site visits, foxes and fox tracks were noted around the base of the tower. Bear tracks were noted on the July trip as well as arctic ground squirrels. All these animals as well as eagles, corvids, and gulls can remove carcasses before they are detected by a field observer.

However, no feather spots were noted on any of weekly Refuge surveys or after any recorded BSI events. Additionally, the analysis of the BSI signal recordings does not lend support to this alternative.

The battery life on the sensors has been greater than six months. Some of the sensors batteries have lasted longer than nine months. The original batteries in the sensors is reaching end of their useful life. In the eleven months of deployment the technology has performed well and there have been no significant technological issues. It is suspected that weather events have led to some false triggers and the devices have been modified to filter some of these events.

Citations

Avian Power Line Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute. Washington D.C.

USFWS, 1995. Correspondence to M. Heer. Differential Global Positioning System (DGPS) Environmental Assessment (EA) comment letter. Izembek National Wildlife Refuge, Dated July 11, 1995.

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