

Avian Mortality at Communications Towers

A workshop sponsored by

The United States Fish and Wildlife Service, The Ornithological Council, and The American Bird Conservancy;
held at the 119th meeting of the American Ornithologists Union
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Session Co-chairs: Bill Evans & Albert Manville

The following are edited transcripts made from audio tapes of the oral presentations at the workshop. These texts were transcribed by Elizabeth Laub and Bill Evans, and were edited by Albert Manville. The Co-chairs of the workshop assume responsibility for any errors that may have occurred in transcription. (Clicking on the underlined words will take you directly to the publication section referenced).

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Introduction Number 1

Avian mortality at communications towers: background and overview

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Albert Manville, Workshop Co-chair, Introductory Remarks

I'd like to welcome all of you to our first ever workshop on avian mortality at communication towers. My name is Al Manville, I'm with the Office of Migratory Bird Management, U.S. Fish and Wildlife Service, in Arlington, VA. Our other co-chair, my esteemed colleague is Bill Evans, whom most of you know -- acoustical researcher, ornithologist, who has been working on this issue for some time.

I would like to attempt to set the stage, and put the issue into context of why we are here this afternoon, why this issue is of importance to all of us. Migratory birds are a trust responsibility for the Fish and Wildlife Service (FWS or Service). The Service is responsible for the conservation and management of 836 species of migratory birds, 778 of which are on so-called nongame species, while the remaining 58 are legally hunted; all protected under Migratory Bird Treaty Act of 1918, as amended. While populations of some of our bird species are doing well, in fact some much too well as many of you are aware -- including Snow Geese, urban Canada Geese, Cowbirds and Cormorants -- unfortunately, many others are not. We are seeing continuing declines of over 200 species. Currently, we have 75 species listed as Endangered and 15 species listed as Threatened under the Endangered Species Act. We also currently have 124 species, so-called nongame species of management concern, whose populations are declining, in some cases precipitously. The next step for some of these species could be listing under the Endangered Species Act. I imagine most of you realize this is a train wreck we would prefer to avoid.

This current list of 124 nongame species has increased sizably for various reasons from what was published in 1987, then 30 species of management concern. For some one-third of the 836 species of birds, we have essentially no population data, so what the impacts of the towers and other mortality factors are on these birds we unfortunately don't really know. Thus the individual factors that kill birds including collisions with towers, electric power lines, wind generators, glass windows, cats, aircraft, cars, electrocutions, poisoning from pesticides, oil spills, and other causes are of growing concern to the FWS. What the impacts of towers are to bird populations we simply don't know.

That's one of the reasons why we are here this afternoon. Add to this the impacts of the loss and/or the degradation of habitat to the above list of bird threats, and the overall problems of bird survivorship and population stability can be critical ones. Birds are big business in North America, and I might point out that we must not underestimate their importance. Some 65 million Americans feed, photograph and watch birds and spend more than \$21 billion per year pursuing these activities. Birdwatching has become America's fastest-growing hobby increasing 150 percent in the past decade. More Americans today reportedly go on vacation to watch birds than to play golf. Birds pollinate flowers and remove insect pests from many important commercial food crop and forest species making possible a multi-billion-dollar industry extremely dependent upon birds for their success.

Take, for example, one pair of adult warblers that will remove caterpillars from more than one million leaves in a two-to-three-week period while feeding their nestlings. In the Pacific Northwest, 24 species of neotropical migrants feed on western spruce budworms and Douglas-fir tussock moths, two of the most destructive defoliating insects in that region. Birds remove countless weed seeds including exotic species that compete for food crop and forest production. Birds distribute seeds of important forest, shrub and tree species whose survival would not exist without bird-seed dispersal. The global reduction of pollinators, including birds, raises alarm. Two-thirds of our flowering plants are pollinated by birds, bats and insects producing a global economic benefit estimated at \$117 billion per year. In short, birds are extremely important to us all.

While the FWS plays other roles in the review of tower permitting and placement through the National Environment Policy Act and Section 7 of the Endangered Species Act, as you'll hear from Robert Willis later this afternoon on the second panel of speakers, the Office of Migratory Bird Management became actively involved in a tower-kill issue early last year. By now many of you are well aware of the large kill that occurred on January 22, 1998, at three towers and a natural gas pumping facility in western Kansas where up to an estimated 10,000 Lapland Longspurs and a few other species were killed that one snowy, foggy, night. The issue of the bird kill at that site was almost immediately brought to our office's attention by the American Bird Conservancy, The Ornithological Council, the National Audubon Society and other groups asking what the Office of Migratory Bird Management was going to do about this problem. On April 6th of last year, I was asked to brief the Policy Council of the American Bird Conservancy on, among other things, the mortality from bird strikes at communication towers. At that time, I provided a partial but not complete literature review and list of abstracts put together by Migratory Bird staff member John Trapp. Following that meeting, informal discussions continued with representatives from the Federal Communications Commission (FCC), the Service's Division of Habitat Conservation, and the Office of Migratory Bird Management. On November 17th of last year, representatives from the Service's field, regional, and Washington, DC, offices met at Adam Kelly's office at Geo-Marine in Panama City, FL, to discuss, "Migratory bird conservation and communication towers: avoiding and minimizing conflicts." Many of you, I hope, have had a chance to look at the detailed minutes of that meeting which were disseminated to the public. In December, Robert Fisher, senior mediator for the environmental dispute resolution group RESOLVE, met with several of us to discuss next steps.

The culmination of that discussion led to a meeting on June 29th of this year with 42 stakeholders from the scientific, agency, non-governmental, and industry perspectives, many of whom are here this afternoon. The meeting focused on research needs. A Communication Tower Working Group was formed consisting of 15 stakeholders from the RESOLVE meeting. The group's task is to create a structure to put into place what research needs were discussed at that June 29th meeting. Those research needs are to be further discussed this afternoon which is exactly what we intend to do. What we hope to learn today will help in formulating a research protocol and further identifying research needs.

At the RESOLVE meeting, I indicated the Service's interest in developing a partnership with the communication industry much like we already have with the electric utility and wind generating industries. We need to look to the electric utility industry through the Avian Power Line Interaction Committee also of which the Service is a member, and to the wind generation industry through the Avian Subcommittee of the National Wind Coordinating Committee, also to which the Service is a member, to see what these industries have done with similar bird collision and electrocution problems, and perhaps look at their research protocols, and their metrics and means documents, as a guidance and model of what we need to do next. Paul Kerlinger will discuss, in part, this issue this afternoon. I also had attempted at the RESOLVE meeting to reiterate that the purpose of that meeting was not to lay blame. We have no intentions of shutting down the communication industry nor do we intend to enlist our sister agencies, the FCC, the Federal Aviation Administration, and the Biological Resources Division of the U.S. Geological Survey, to conquer new territory and combine forces to block industry growth.

The focus of this workshop, as was the focus of the RESOLVE meeting, is to review known, anticipated, promising, and new research opportunities that will result in minimizing or even avoiding bird collisions and mortalities.

Some have argued there is nothing we presently can do. I would disagree. The Service currently recommends the following, especially for new towers: 1) If it all possible, co-locate. Put a planned tower on an existing tower or on another structure. 2) Keep towers below 200 feet if it all possible. The magic formula for lighting is anything taller than 199 feet above ground level (AGL) is required by the FAA to be lit -- and we will hear from David Bayley this afternoon from the FAA more about those initiatives. 3) Keep towers unguyed if at all possible because the guy wires are very problematic to the birds. 4) If it all possible, keep the towers unlit. There are a number of towers less than 200 feet that are lit and they may not necessarily need to be. Mike Allred will discuss this issue in part this afternoon as well. However, there are still many questions that we need to answer; let me throw out a few of these to you this afternoon.

Question: how many birds are actually killed annually by towers? Dick Banks authored a special FWS scientific report in 1979 projecting annual mortality at upwards of 1.4 million birds per year based then on 1,100 existing tall towers. Today the FCC's February 1999 Antenna Structure Registry Database places 48,642 lit towers greater than 199 feet AGL in the United States, and this figure does not include towers classified as "poles." Some argue the figure could be closer to 80,000 lit towers. We do know that more towers are planned, including the digitization of all television stations by 2003 requiring an estimated 1,000 additional what I would call, "mega-towers" (these are towers greater than 1,000 feet AGL) that are going to be placed around the country.

Question: what are the true impacts of the existing and planned new towers? Answer: We don't know. Based on Bank's estimate, data from Tall Timbers Research Station and other sources, Bill Evans conservatively estimated current annual mortality at upwards of four million birds. The figure could be off by an order of magnitude. Again, we simply don't know. Perhaps a detailed research analysis might answer this question, but we don't need reliable mortality data before we act. I must stress this point. We already know that we have an important conservation problem and we need to deal with it now. If I may borrow from an extrapolation that Ron Larkin put together -- one of our speakers this afternoon -- if towers presently are killing four million birds per year, that means that towers are on average killing one bird every seven-and-a-half seconds, every day and every night, all year long. These are mostly the little birds, the songbirds. So this is, I would say, a fairly significant impact.

Question: what tower characteristics are least likely to cause migratory bird collisions? In answer, probably towers less than 200 feet AGL, unguyed, and unlit.

Question: can we come up with relative risk categories of tower characteristics that cause bird kills based on the best existing information? Answer: we attempted to do that at Panama City, FL, last year but there needs to be more work done on it.

Question: are lights and light colors the problem or is it the duration, the relative amount of dark vs. light, during the blinking cycle of the light that makes a difference? Answer: Michael Avery, Sid Gauthreaux, and Bob Beason have some important suggestions that I hope they will share with us this afternoon on this very issue.

Question: what radar, acoustic and ground survey techniques will be useful in determining major migratory bird movements and bird migration timing? Answer: We will hear from Bill Evans, Adam Kelly and others on this issue this afternoon as well.

Question: can we develop an effective monitoring protocol? Answer: Paul Kerlinger will address this issue in part.

Question: what is the scope of research already completed or in progress? Answer: Unfortunately, there isn't much.

Question: what research needs to be conducted? Answer: Ellen Paul presented a good framework for a research study at our RESOLVE meeting. Michael Avery expanded on Ellen's suggestions and this is what was suggested.

We need a randomized selection of tower study sites, stratified geographically, statistically rigorous, of various tower height classes over a three-to-five-year period, spring and fall, focused on lighting schemes including the use of radio telemetry to determine bird movements towards lights to assess their responses and develop preventative measures. Sounds like a very interesting suggestion to say the least.

And question: what can we do with existing towers and new planned towers? In answer, with existing towers there isn't too much, but if they are currently lit with either solid red or blinking red lights, the white flashing strobes seem to be of less hazard and impact to the birds so we would recommend the lighting scheme to be changed. And with new planned towers, there are a number of things we can look at. Siting is important. Keeping the towers less than 200 feet, unguyed, and unlit, and if they are over 199 feet, suggest using white strobe lights rather than the red flashing incandescent lights. There are obviously many more questions about the impacts of towers on birds than we have answers, but to answer these many questions we all need to be working together. We also need to do whatever we can now to minimize impacts, not necessarily wait until the detailed research study is completed. To reiterate, what we can do is co-locate, keep towers unguyed, unlit, and under 200 feet, and if they have to be lit use the white lighting protocol.

So with those thoughts, let me pass the baton to our Co-chair, Bill Evans, for his thoughts and observations this afternoon. Thank you.

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Introduction Number 2

Avian mortality at communications towers: background and overview

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Bill Evans, Workshop Co-chair, Introductory Remarks

I remember first hearing about bird mortality at communications towers as a teenager in southern Minnesota back in the mid-1970s. One of our local television stations had its transmitter on a 1000-foot tower south of town. I was an avid birdwatcher at the time and I remember one of the local birders telling me that people had picked up dead warblers by the pail full under that tower on foggy nights. But it wasn't until 1996 that I became compelled to action on this problem of bird mortality at communication towers. At that time I was in north-central Nebraska and I had been contracted by a power company to study nocturnal bird migration at a proposed wind turbine site. These structures were to be 200 to 300 feet tall with a single light on top, and the power company wanted to know what species were migrating over at night that might be affected by the turbines.

In North America, most of the bird migration happens at night, and many species give calls when they migrate, apparently to keep in contact with one another. Monitoring the night flight calling of migrating birds is the only means to get species information of birds in active migration over a region at night. The technique I've been working on for the last 15 years uses microphones to monitor the calls of night migrating birds to get information on the species that are flying over and to make inferences about relative abundance. So, in 1996 when I arrived at the proposed wind turbine site in Nebraska, I found a 317-ft. [97 m] guyed communication tower and prairie as far as the eye could see. I decided to put one of my acoustic monitoring stations under the tower, aim it at the sky, and see what the recordings revealed. I tape recorded 8 hours of sound coming down from the sky every night for the fall migration period of 1996 and the spring migration period of 1997. I analyzed the tapes back in Ithaca, NY, where I live and this consisted of simply listening to all the tapes to see what bird calls, and how many, were recorded.

It was then that I was very surprised to discover that I had recorded some bird collisions with the tower. There were a number of incidents on quiet nights when you could actually hear the wing beats of ducks as they approached the tower, then a collision sound, and in one case, a thud on the ground near the microphone as a bird apparently hit the ground. A Blue-winged Teal was found dead under the tower near the microphone. What surprised me even more when I listened back to these tapes was the number of incidents of alarm calls of various species of ducks. I would be listening back to one of these tapes and suddenly I would hear vocalizations from ducks, but they didn't sound like vocalizations I had recorded in the past 15 years from other regions of the country. These were alarm calls, and on some evenings dozens of such incidents were recorded. I came to the conclusion after sitting and listening to hundreds of hours of tape that these birds were flying along at night in the dark and they just didn't see the tower until they were right upon it. Many apparently became aware of the tower right at the last minute and gave alarm calls as they attempted to swerve - sometimes it was evident from the recordings that the birds would collide with one another. This made a great impression on me. I thought, wow, even these relatively short communication towers are dangerous for migrating birds.

I hadn't really considered the hazard from shorter towers.

Shortly after analyzing the Nebraska data, in July 1997, the new issue of *Smithsonian* magazine came out with an article that mentioned the new digital television system soon to be implemented across the continent. The article quoted estimates that a 1,000 new towers 1,000 feet tall or higher might be needed across the continent to accommodate the new digital antennas. About this time I looked around the hillsides here in New York State and saw the evidence of all the new cell towers going up, and I very quickly became tuned to the great proliferation of towers occurring on the continent today. This realization, combined with concern over declines in the populations of many species of birds generated by the results of the USFWS's Breeding Bird Survey compiled in the 1980s, catalyzed my interest in this issue. In late 1997, a number of organizations – the National Audubon Society, the American Bird Conservancy, and the U.S. Fish and Wildlife Service – started to network on this issue and the momentum for addressing the problem started to grow. The large kill of Lapland Longspurs in western Kansas in January of 1998 ignited the effort.

We have a different climate now than we had back in the 1950s and '60s when these tower kills were first noted. We now have a situation of concern about declining populations for many species of songbirds and we have a deluge of new tower construction. These developments have amplified the fact that we have very little research on this issue. But a key ingredient now moving this issue forward is a concept that this problem might have a simple solution. When I looked around back in 1997 to see if there had been any mitigation research on this problem, I found very little out there. However, the research I did find was very suggestive of a solution, in particular, the now classic work of Dick Graber and Bill Cochran back in a late 1950s. Graber and Cochran waited for a night when the weather conditions caused birds to fly about in the lighted area around a tall television tower. Then, they simply turned the lights off on the tower. Within a minute or two the birds left the vicinity of the tower. By simply turning off the lights they eliminated the major mechanism for mortality at towers (Avery *et al.* confirmed these findings in the 1970s). So, the major motivating forces for getting this meeting together today are, first, that there really hasn't ever been any mitigation research or any concerted effort to address this problem – a problem that is getting greater every year as towers over 199 ft. [61 m] are now increasing in the U.S. by more than 5,000 per year. Second, the scant research that is out there is very suggestive that a mere small change in the length of the dark phase of the blinking aviation warning lights on these towers could prevent the bulk of the avian mortality at towers in North America every year.

There are other sources of bird mortality that likely are larger than that incurred by towers. Mortality from cats, windows, and automobiles are undoubtedly larger. But the difference with this initiative toward reducing tower mortality is that we have solid ground for believing that a simple solution may exist for greatly reducing it. So, we thank you for coming here this afternoon to help us address this problem and make our broadcast and communication technology as harmonious as possible with nature.

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Presentation Number 1

Lights, towers, and avian mortality: where is the science?

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Al Manville's introduction of the first speaker, Todd Engstrom.

Our first paper this afternoon is a co-authored paper by Robert Crawford and Todd Engstrom. Robert worked at Tall Timbers Research Station in Tallahassee, Florida, from 1970 to 1985. His major responsibility then was carrying on a mortality study at a nearby television tower. He has since left Tall Timbers to go on to other endeavors but he has continued to do contract work on the archives at Tall Timbers. Our speaker this afternoon, Todd Engstrom, has been staff the ornithologist at Tall Timbers Research Station since 1990. Among other things, he has addressed issues dealing with the ecology of the Red-cockaded Woodpecker and bird populations, and relationships to fire ecology and silvaculture. The title of Robert and Todd's presentation is, "Lights, towers, and avian mortality: where is the science?"

Todd Engstrom

The first thing that I would like to point out is that bird kills at tall structures are a very old phenomenon. Avian mortality at tall lighted structures has a very well-documented, although anecdotal history. For example, in the 1891 Sherlock Holmes thriller, *The Man With the Twisted Lip*, Arthur Conan Doyle's character Dr. Watson says, "Folk who were in grief came to my wife like birds to a lighthouse." Famous lighted structures such as the Washington Monument and the Empire State Building have had bird kills for many years. Both the structure and the lights are implicated as causes of avian mortality. Many light sources not associated with prominent structures, such as ceilometers, fires for hunting and trapping, and even handheld flashlights are associated with bird kills. Again, a very large anecdotal literature database points to lights as a major factor in these mortality events.

I would like to present a brief summary of a long-term study of avian mortality at the WCTV tower in north Florida. After World War II, tall communication towers proliferated and observers began to record bird kills at them. Knowing this, Herbert Stoddard, the highly regarded naturalist, got permission to conduct a study of bird kills at a recently constructed television tower on the Tall Timbers Plantation. Two years later after he started the study, this Plantation became the Tall Timbers Research Station. Stoddard voiced a prescient concern in 1962 when he noted, "unfortunately for the birds there are some 500 TV towers in the United States and their number and height are fast increasing."

The WCTV tower is about half an hour north of Tallahassee, Florida. Height of the tower ranged from 204 m (1955 to 1960) to 308 m (1960 to 1989) to 94 m (1989 to present). The methods for the study were straightforward: daily inspection for 25 years. That's over 8,500 mornings that Herbert Stoddard and Tall Timbers staff went out to look for dead birds. As Stoddard said, "a tower-kill study is not for '10 o'clock' biologists." It was critical to be at the tower at dawn or pre-dawn to detect the kills.

Another important ingredient of the WCTV study was maintaining the grounds “like a well-cared for golf course,” which is essential so that researchers can find the birds. Finally, and perhaps the most important, is rigorous control of the predator/scavenger community, because many of the killed birds may be removed before they are detected by observers.

Over the 25-year study period, more than 42,000 individuals were killed representing 189 species. The largest single kill, interestingly enough, was about 4,000 to 7,000 individuals that occurred less than two weeks after Stoddard initiated the study. A graphic summary of the number of individual birds killed annually over the first 15 years of the study indicates that the last three years, 1967 through 1969, are much lower than the previous 12 years. Evidently, Herbert Stoddard's health was declining from 1967 to 1969 and he didn't do nearly as much to control the scavengers and predators. If you exclude those years and take the average number birds killed per year, we estimate that there were over 2,600 birds killed per year at the WCTV tower. That is more than you would get from taking the average of 42,000 birds over 25 year, but we believe that the 2,600 is closer to reality.

The seasonal pattern during the year is what you'd expect. About 20% of the total number of bird kills was during a 2-month period in the spring and 65% was in a 2-month period in the fall. The higher fall mortality is caused primarily by the large number of young birds migrating for the first time, but the migration route of some species also changes with the seasons. The Chestnut-sided Warbler, for example, migrates farther to the east in the fall than it does on its return spring migration. This is reflected in the tower kill results at the WCTV tower. All of the 480 Chestnut-sided Warblers killed at the tower were killed in the fall.

Species composition of the WCTV tower kills is revealing. Of a total of 189 species, the top 50 species, the species with the most abundant number of individuals killed, comprise about 90% of the total mortality. What are these species? The top 50 most abundant species that were killed at the WCTV tower are in 11 families; warblers and vireos, the top two families, make up nearly 62% of all the individuals killed.

Nightly patterns of mortality vary from a single individual to thousands. The nights in which thousands of birds are killed have characteristic weather conditions. These large bird kills are almost invariably associated with inclement weather along frontal boundaries during the period of heavy migration. The nights in which thousands of birds are killed are very dramatic, but these types of kills are only part of the story. The 25 largest kills represent about 30% of the total number of individuals. This means that some birds were killed almost nightly during migratory periods. This low-level of mortality is cumulatively a large proportion of the total loss of birds. This low-level of mortality, which is very important over time, can easily be masked by predation.

In conclusion, we use this quote from R.D. Weir in 1976. “Nocturnal bird kills are virtually certain wherever an obstacle extends into the airspace where birds are flying in migration. The time of year, siting, height, lighting, and cross sectional area of the obstacle, and weather conditions will determine the magnitude of the kill.” This is the most succinct description of the state of knowledge that we could find. We recommend that experimental studies of different lighting schemes on bird behavior and mortality be initiated. Any such studies must consider the influence of scavengers on the number of birds that are collected.

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Presentation Number 2

The bird brain: magnetic cues, visual cues, and radio frequency (RF) effects. Robert C. Beason, Ph.D.

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Al Manville's introduction of the second speaker, Robert Beason.

Our next speaker is Alumni Professor of Biology at the State University of New York at Geneseo. He has been a previous consultant for the New York State Department of Environmental Conservation, as well as a consultant for Deutsch Telecom, NASA, the Kennedy Space Center, the FAA, and the United States Air Force. His research areas of interest include magnetic sensory perception in animals, especially in birds. He has done studies on visual pigments and oil droplets in birds and the mechanisms of avian color vision, animal orientation and migration, navigation, bird migration, radar ornithology, and the evolution of nearctic and neotropical bird migration. Dr. Bob Beason is going to be talking about the bird brain, the magnetic cues, visual cues and radio frequency affects.

Robert Beason

As Bill pointed out at the beginning of this workshop, avian mortality at communication towers occurs when the birds hit a tower or its guy wires. The rate of collision increases as birds are attracted to the tower or become disoriented near the tower and fly in circles around it, getting repeated chances at hitting the guy wires. Two aspects of the tower that might potentially affect its attractiveness are its illumination and the RF signal that is transmitted by the antenna itself. Light can have behavioral effects on the birds through two sensory systems: the visual system and the magnetic perception system - the magnetic compass. Color perception in birds is much more complex than it is in humans. Birds have 4-6 different types of color receptors, or cones, where as humans have only 3. The avian photoreceptor itself is more complex than in humans and other mammals. In addition to the visual pigments, birds also have an oil droplet in their inner eye segment that acts as a filter determining which light reaches the photo pigments themselves. Each photoreceptor has one oil droplet and one photo pigment or visual pigment. So far, of all the avian species that have been examined, all of them have a very narrow, very sensitive channel in the red spectrum. This is of interest because most of the illumination that is put on towers is in the red region. This red cone has a peak sensitivity of about 600 nm, which is what we call a reddish orange. By comparison, the human red cone has a peak sensitivity of about 560 nm. Depending upon the species of the bird, they either have an ultraviolet sensitive cone, or a violet sensitive cone that is totally missing in humans and most mammals. In fact, humans have oil droplets in the lens that filter out the ultraviolet. So birds can see ultraviolet and apparently have specialized receptors for detecting it. It varies from species to species, but there are 2 or 3 additional receptors that might be analogous to what we call blue, the green and the yellow wavelengths. In the Bobolink, one of the species I work with, these peaks are at 460, 535 and 570 nm. Humans, for comparison, in addition to the red cones have the blue and green cones that are at 430 and 530 nm.

Of the 10,000 species or so of birds, depending on whose taxonomy you want to deal with, we know the photo pigments or the visual pigments and associated oil droplets for exactly 11. Only two of these are nocturnal migrants in the Western Hemisphere: the Bobolink, again the species I work with, and the Mallard. Another is considered to be a diurnal migrant: the European Starling. Partial information is available for a few other species, but for very, very few, and most of this is simply limited to oil droplets information.

We don't know the spectral sensitivities of the visual pigments with which they are associated. Consequently, we know very little about what colors birds can actually detect and how well they can differentiate between colors. The visual pigment of the rod for comparison is very similar to the human rod pigment with a peak of around 500 to 510 nm, in the green range. Birds have very large rods, at least the species that I have looked at so far, which means that they have very good night vision – they have very good sensitivity to moving around at night. The rods lack the oil droplets; they have only the visual pigments, which makes sense if you want to have something that is very sensitive to light. Illumination at specific wavelengths of light might affect a taxis-like response, whereby the bird is attracted to the light or the communication tower. There are anecdotal reports that the attraction of birds to lights is strongest in adverse weather especially in fog, as Todd pointed out previously. The attraction of birds to these lights might simply be an escape response, whereby the bird flies towards the brightest part of the night sky, which under natural conditions would represent the moon. Flying towards the moon would simply get the bird above any fog or low-lying clouds and out of any potential problems.

Two aspects of tower lighting that can attract birds are its color (white lights, ultraviolet, or specific wavelengths) and the duration of light (stobes, flashing lights, or steady lights) as pointed out previously. Both these aspects remain unresearched. Unfortunately, there have been no controlled experiments as to which colors birds find most or least attractive. Anecdotal reports, again as AI has pointed out earlier, are that white lights seem less attractive than red lights, and stobes might even be less attractive, but we really don't know.

A second avenue of the influence of light is disorientation that is caused by the disruption of the magnetic compass. Long wavelengths of light in the red and orange part of the spectrum have been shown to produce disorientation, or a change in the direction of orientation, in the 5 species of migratory birds that have been tested. This long wavelength illumination interferes with the magnetic compass of the species, but it isn't known what the birds might do if other sources of information, such as stars, were available at the same time. The mechanism by which the wavelengths of light influence magnetic orientation is not known either. There are a couple models put out, but no one has been able to validate or invalidate any of them. All experiments that have been tested with migratory birds have been done with very narrow band filters or LEDs and researchers have only looked at the particular wavelengths that were of interest. These might resemble the conditions that a bird would encounter during fog or inclement weather when it was flying very near to a communication tower that was illuminated by say, red lights. Under normal conditions, in addition to this red light from the tower, the birds would also have starlight and perhaps even moonlight. Whether this additional illumination would simply cancel out or negate the effects of the red illumination on the magnetic compass isn't known. No one has looked at it. Disruption of the bird's navigation system and the magnetic navigation system might occur with either red lights or the RF signal if it were to interfere with the bird's ability to detect the magnetic field. If this resulting disorientation causes the birds to circle, to be unable to establish its directional cues, it would increase the probability of striking either the tower or the guy wires.

Most of the research on the RF signal has shown no behavioral affect on the birds. With one exception, all the reports that have found a response have been with tracking radars. The responses have been deviations in the headings of the birds that persisted only in a short distance from the radar antenna. Most of these effects were not consistent and attempts to replicate them were unsuccessful. The most recent report that there was no affect or little effect on migratory birds was published by Bruno Bruderer just a few months ago, along with his colleagues in Switzerland. There is only one report of a continuous transmission RF signal producing disorientation in birds.

This is work that was done several decades ago by Bill Southern working with gull chicks when the chicks were placed in a test arena immediately above a very powerful low frequency Navy transmitter that was used to communicate with submarines. When the transmitter was energized, the birds were disoriented. So at this time, it seems the RF signals produced by communication towers have no general disorientation effects on migratory birds. But again, controlled experiments in which towers were energized or non-energized and the affects on the birds transiting the area have not been conducted.

On the other hand, Peter Semm and I have found that a pulsed microwave signal results in changes in the rate of spontaneous activity of superficial neurons in the avian brain. The signal in this case was a tenth of milliwatt per square centimeter. This is about 10 times as powerful as a cellular telephone puts out when it is right next to your head. About half the spontaneously active neurons that we have recorded, responded to this pulsed gigahertz signal. Most of the cells respond with an acceleration of their activity, that is, they were stimulated. A few responded with a depression of their activity or inhibition. Whether these changes in the nervous system were reflected in behavioral changes, we have no idea. It is unlikely that the effects we observed were the result of thermal excitation, such as microwaves exciting water molecules, because we were one one-thousandth of the signal intensity that is needed to raise the tissue 1/2 of a degree. So thermal excitation wasn't a factor.

These high frequency fields produced a response in many different types of neurons that we recorded. There is no indication that there were specialized receptor cells that were responding to the signal. Consequently, these responses are occurring in higher centers of the brain, not in the lower centers where they could be filtered out.

In conclusion, there are numerous questions related to the features of communication towers for which we lack basic knowledge of either the neural or the behavioral responses of the birds. Gaining this type of information is paramount in determining what features of these towers can be modified in such a way to decrease their attractiveness to birds to allow communication field engineers to design and construct these towers in such a way to reduce the impact on migratory birds.

**Presentation Number 2
in the workshop
Avian Mortality at Communications Towers
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Presentation Number 3

Investigating the behavioral mechanisms of tower kills

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Al Manville's introduction of the third speaker, Ron Larkin.

Our next speaker is a Wildlife Ecologist at the Illinois Natural History Survey, where he has worked since 1980. His research interests center on migration, dispersal, homing and communication especially as related to the conservation of habitats and species. He was one of a number of folks who participated in our RESOLVE discussion on June 29. His topic is investigating the behavioral mechanisms of tower kills. Dr. Ronald Larkin.

Ronald Larkin

[Slide of carcasses of 21 species of songbirds killed at an east-central Illinois communications tower on the night of 10-11 October 1985, arranged on a tray]

Here is the phenomenon we are talking about today. These were birds that were picked up beneath one 1,000 ft. [308-m] communication tower after a night when there were low clouds in the fall, during nocturnal bird migration. These are mostly warblers, sparrows, and vireos--attractive small birds. Most of the birds have injuries; look closely around their eyes, on their heads and beaks, and the front edges of their wings. This indicates they had collided with something, either with the tower or when they fell down to the ground. It is sometimes hard to tell the difference. A collar there came from a domestic cat, probably one of the scavengers that Todd Engstrom talked about. One of the problems with this research is that the local small animals, especially mammals, get there before the scientists do and the scavengers pick up the carcasses and take them off. However, on a night like this with a heavy kill there just aren't enough scavengers and there are plenty of carcasses left for the biologist to find. There is also an owl feather there, indicating there are bird predators around. This is the kind of phenomenon that we are talking about today.

[slide, portrait of Richard R. Graber]

As was mentioned earlier, Dick Graber, who was formally an ornithologist at the Illinois Natural History Survey -- my organization -- has come up with a hypothesis trying to explain this. We are going to hear several hypotheses today, and I would like to emphasize--and I'm sure the other speakers will agree--that we have very little means of discriminating among these hypotheses right now. We don't know what the phenomenon is we are dealing with, really. We are groping around in the dark like the birds are. Anyway, having watched birds at towers, Dick Graber hypothesized that the birds are flying around the towers in circles, in the same way that animals are kept inside zoo exhibits without bars. Birds in such exhibits don't like to fly from a lighted area out into a darker area. Similarly, birds flying near a lighted tall structure in clouds stay in the lighted area and fly around with light all around them. Since they are in a cloud there is no visible, directed source of light, but they stay in the lighted area flying around and around. Eventually they strike a guy wire and often it kills them.

This is a plausible mechanism for the birds being killed at towers. It doesn't really explain the neurophysiological responses of the birds and doesn't explain the selection pressure that causes them not to leave a lighted area during nocturnal migration, but it's a partial behavioral explanation of the phenomenon. I would like to argue today, that until we know why these birds are killed,--until we can observe how this happens--we are going to be left with many ideas and no clear direction in which to attempt to alleviate the problem.

I would like to talk about some research that Dr. Barbara Frase and I did in the mid-1980s [*Larkin, R. P. and B. A. Frase. 1988. Circular paths of birds flying near a broadcasting tower in cloud. Journal of Comparative Psychology 102:90-93.*]. I am talking about these old data because they are some of the few data we have that actually show us something and gives a hint of what's happening during this phenomenon.

[Slide of WNMU tower in daylight, with X-band tracking radar dish in foreground.]

This is a 1,000-foot [308-m] communication tower, the ordinary kind that you usually listen to on your radio or watch on your television station. It is located in the Upper Peninsula of Michigan with very few lights or other human disturbances around. The object in the foreground is a tracking radar. Dr Frase and I were following the birds as they flew towards this tower. On one particular night, the tower started out at sunset on a nice, clear night and you can see the red lights on the tower. Every other light flashes, the lights in between are steady red lights, one of the standard FAA approved lighting schemes for these tall towers.

[Slide of the top of the tower in the dark, showing the top 6 red lamps, alternating 3 steady and 3 that blink slowly.]

This is how it looks at night. You can see the alternating lights having just flashed. They are different colors from the steady lights. During the course of the night, the clouds descended. [*Similar slide but with the top lamps obscured by low cloud, at 0255.*] This is the same picture of the frame I just showed you, but the cloud is now obscuring the top of the tower. You can't see the lights, and the birds can't see the lights presumably until they are close to the tower. These are the conditions that kill birds most of the time, that cause heavy kills. We were fortunate enough to have this instrument operating on such a night during the fall. We didn't have another opportunity, another night with these conditions, and we never repeated these observations, unfortunately. So I am talking about one night worth of data here.

[Slide of a radar track of a bird engaged in normal nocturnal migration. In this and subsequent figures, the bird's path is shown in XY (map) coordinates with the bird's height shown in an inset plot.]

This is a bird flying in normal migration past the tower. This was actually earlier on the same night, I believe, when the cloud was not obscuring the tower. This bird is flying at a high altitude past the tower, very straight and level. The symbol that looks like a capital "A" in the top middle of the diagram is the tower. That is the aviation signal for a tower [*shaped like an upside-down capital "V".*]. And a little tracking radar like symbol is pointed where the bird was at the end of its track. The inset with the box around it is the bird's altitude; you can see the altitude is 1,100 meters mostly. That is higher than the tower, which is about 300 meters, about 1,000 feet tall. This bird happens to be going in a west to east direction for reasons best known to the bird itself.

[Slide of a bird flying inside the cloud, circling the tower at time 0237.]

Now here is the kind of thing that happened after the clouds descended on the tower. These observations were taken mostly after midnight on this night, and the public broadcasting station that uses this tower turns its radio transmitter off after midnight, so there were no radio signals from this tower.

So we clearly can rule out one possible explanation of these data, namely that the birds might be responding to the radio-frequency emissions from the tower. But the lights are still on. The slide shows a big circle the bird has made. The circle goes counter clockwise and the altitude changed slightly during the circle as you can see. The circling happened very, very slowly.

This track is three minutes long as the bird circles the tower making a big loop. We have several more of these circling tracks and most of them are segments.

[Slide of another partially-circling bird at 0457,]

Let me point out that the tracking radar is doing its best to track something about half the size of my fist at a distance of 1 km when there is a huge steel structure with tons of steel competing with the bird for the radar's tracking mechanism, so it was technically tricky trying to track little birds next to this big reflective tower. Therefore, we didn't get very many long tracks. *[Slide of bird that appears to successfully escape the tower's influence, at 0442.]* Here is a bird that loops around making almost a "J" shape yet hovers there and then it heads directly south towards the second tower which is south of the radar. So this appears to be a bird that had been circling, comes to a point, breaks away, and manages to leave the tower. It did not continue circling.

[Slide of bird approaching the tower, at 0504.]

Here is a bird that encounters the tower, slows down, hovers and starts making a circle. So you can see the bird in a process of starting to circle the tower here. But this is all the data we have on this particular bird. This one was very level as you can see from the inside plot. My last slide that I am going to show today shows the data in clear conditions and on other nights we had very few birds circling the tower.

[Slide of summary table from Larkin and Frase 1988 article.]

These judgments were made, by the way, in a blind situation, so that the person who made the judgment that a track circled or did not circle the tower had no idea whether it was cloudy or not. So, even though it's subjective, it is scientifically rigorous and these are highly significant data although we didn't do a statistics test on them because really we only had one night's selected observations. We were trying to select birds that were flying towards the tower so we did not feel good about doing statistics. But, as you can see, the cloudy conditions were really important in causing this behavior to happen at this tower during two fall migrations in the 1980s.

I'd like to spend the rest of my talk showing other ways that might be possible to do research on this subject. Clearly, you can observe what happens at these towers if you have the right equipment, at the right place at the right time. We can study this phenomenon. I will go through some of my ideas on the subject rather quickly.

To manipulate light:

- It might be possible to wash out the bird's retinas, to use a series of flash bulbs on the towers so that when the bird approaches the tower, you wash out the retinal pigments and see whether a bird that does not have its dark adapted vision still circles the tower. You can experimentally test the hypotheses that way.
- You can ask whether tall towers in areas that are polluted by lights in cities, a lot of these towers are now in cities or suburbs, you can ask if they kill birds at the same rate as towers that are in rural areas that do not have large washes of light around them.
- You could put mirrors below the lights, so the light shines only upwards. This should cause the birds to spiral down as they circle the tower.
- You could paint the guy wires with fluorescent paint and illuminate them, making the guy wires really visible to the birds. The bird might avoid the guy wires, you might not kill as many birds that way. The guy wires are usually oiled (I understand) anyway, so people have to go up there and do something to the guy wires regardless.

To observe the birds' behavior:

- You could use radar to follow the birds, as I have shown. An ordinary old-fashioned tracking radar works. A coherent radar that can measure the birds speed would allow one to track a small moving object very close to a big stationary object much easier. So you could use a coherent radar to track a bird.

- Or you put a coherent surveillance radar, like a little Marine radar (as long as it was coherent) up on the tower and actually watch birds flying in the vicinity of the tower. This could be done even though you are on a big steel structure, because you are using the right kind of radar.
- You could take four or more microphones and localize where these calls are around a tower. Bill Evans has done this many times. You have a big steel structure there, you could hang microphones on the tower and follow birds by their calls.

To test if the birds are stressed:

- In terms of the paths of the birds on the “right” [*speaker makes quotation marks with forefingers*] night, when the birds fall to the ground, one of the old hypotheses is that the birds flying around and around and just tired or they are stressed and they fall down to the ground and they die when they hit the ground. A perfectly good idea.
- One way to do it might be to take a bomb calorimeter and measure the amount of water and the amount of fat in the bird when it hits the ground and compare that to the amount of water and the amount of fat in similar birds that are caught in mist nets that have successfully migrated the next morning and are caught in banding stations. You might be able to actually measure whether these birds are exhausted when they fall down. This is one of the common hypotheses.
- [*A little later in the meeting, during questions, another presenter pointed out that hormone levels such as adrenocorticoids could be measured.*]

To do experiments:

- Even the FAA (I think) would approve of instrumenting a tower with both flashing lights and red lights and alternating one vs. the other, say one hour worth of flashing and one hour worth of steady lights.
- You might be able to combine this with putting a Doppler radar, a very simple instrument, just below the tower shining upwards, just like a police radar, so then when the bird flew this way you would hear nothing, when the bird falls you would hear the bird dropping as the bird came down. You would hear that from the radar as the bird approached.

I'll quit with these ideas now. I just wanted to demonstrate that with a little research funding and ingenuity, it is possible to ask questions about how towers kill migrating birds and expect to get scientifically rigorous answers.

**Presentation Number 3
in the workshop
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Presentation Number 4

The behavioral responses of migrating birds to different lighting systems on tall towers.

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Al Manville's introduction of the fourth speaker, Sidney Gauthreaux.

Our next speaker is a native Louisianan. He did his undergraduate work at the University of New Orleans and his graduate work at Louisiana State and a postdoc at the University of Georgia. He has worked as Assistant and Associate, and is currently Professor of Biological Sciences at Clemson University. I look at him as the Grand Master, if you will, of radar ornithology. He began work in 1959 on weather surveillance radars looking at bird migrations and since that time has been studying radar movements of birds across the Gulf of Mexico, eastern United States, spring and fall. And, of course, with the advent of Doppler radar has improved his efforts tremendously. Last year he was the recipient of the Partners in Flight Researcher of the Year award. Dr. Sid Gauthreaux.

Sidney Gauthreaux

[the following text is the author's abstract for the conference]

The influences of both red and white light on the flight and orientation behavior of nocturnally migrating birds were investigated by 2 means in an attempt to assess the possibility that strobe lights may deter birds from colliding with tall man-made structures and aircraft. The first method examined the number and behavior of nocturnal migrants flying near a strobe-lit FM radio tower and over a control area during spring migration as well as near a red-lit television tower, a white strobe-lit television tower, and over a control area that had no light during fall migration.

The results show that numbers of birds at each site were not significantly different; however, the proportion showing curved, circling, or hovering behavior was significantly higher at the red-lit television tower than at the strobe-lit television tower and the control site. The proportion of birds showing one or more of these "non-straight" flight responses was also higher at the strobe-lit towers than at the control sites during both the spring and fall studies. The findings provide important information on the "best lighting configurations" for man-made obstructions that can be used to minimize the collisions of migrating birds with these structures at night.

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Presentation Number 5

Applications of avian night flight call monitoring for towerkill mitigation

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AI Manville introduction of the fifth speaker, Bill Evans.

Most of you know our next speaker. He has been a birdwatcher since he was 13, has worked through Cornell University with the Library of Natural Sounds, the largest natural sound library in the world, and has been a research associate and consultant with Cornell's Bioacoustics Research Program. He's going to be talking about acoustic monitoring of nocturnal bird migration as a tool for towerkill studies and mitigation. Bill Evans.

Bill Evans

So far today we've been focusing on individual towers and what might be done to deal with bird collisions. I want to take a little different tact here and look at tower siting on a broad continental level. As I mentioned earlier, most bird migration in North America happens at night and many species give calls while they travel. We presume this is to keep contact with one another. These calls are currently the only link we have to the species of birds in active nocturnal migration over a region -- the species that would be more or less likely to be affected by a tower. So, one of the emerging concepts of acoustic monitoring is that, with some interpretation of nocturnal flight calling, we can map migration densities for many species, at least relative to other microphone stations. Therefore, with regard to tower siting, we could weigh the potential hazard of tower placement or tower height with regard to species.

But let's think this through with a few examples. In the early 1990s, I set up an east-west running transect of seven acoustic monitoring stations across central New York State. Microphones at each site were aimed at the sky and sound was recorded for 8-10 hours each evening during the fall migration period. Data recorded through 3 fall seasons revealed highly variable density patterns among different species. For example, the Bobolink is a species that nests in north-central North America and winters in central South America. Bobolink calls were much more commonly detected in the eastern half of New York than in the west. However, the Veery, a species that nests in the forests of east-central North America and winters in central South America, was detected more commonly in the western half of New York than in the eastern half. This pattern was revealed within any given evening when both species were migrating together, as well as in the general pattern revealed over the 3 years of the study. In some cases acoustic data showed that several species, or a group of species, showed the same general density pattern across the transect. But the point here is that bird migration, even down to the species level, is not typically in narrow beams covering the same stretch of ground from year to year. It tends to occur across a broad front and it is extremely complex with regard to species composition across that front, at least regarding a 300 km cross-section.

The New York acoustic data also suggest that tower siting for some species is not that important within an inland region of say 50 km by 50 km in North America. In other words, the probability of mortality to various species might be about the same within that area.

But one 50 by 50 km area might be better or worse for certain species than another. Combining weather data on the probabilities of fog or low cloud ceilings could further clarify the relative danger of different 50 by 50 km areas. The only way siting within a 50 by 50 km region would be important is if coastlines or mountains were involved. Coastlines, mountain ridges, and valleys or sides of mountains have all been shown to concentrate migrants, often in relatively low flight above ground level. Many of these zones of high bird migration density can be mapped with our current knowledge about bird migration.

Generally, it seems that a particular tower siting does not have the option for location in different 50 by 50 km areas, but rather somewhere inside of a particular 50 by 50 km area. So, the siting of the tower will not be that important regarding general bird hazards. But in 50 x 50 km areas that do indicate high risk of mortality of one or more species of concern, possibly more attention could be paid to tower height and lighting so that hazards are reduced. Certainly 50 x 50 km zones in the vicinity of major coastlines should be labeled as zones of high hazard. Acoustic monitoring, with its capabilities of resolving species information, could play an important role in ranking such 50 by 50 km units for hazard to many species of night migrating birds.

With regard to rare species, acoustic monitoring is less effective. For example, let's consider the Kirtland's Warbler, a Federally endangered species. The whole population of this colorful warbler (estimated population of 2,000 individuals in 1999) nests in a very small region of north-central Michigan. Every year they migrate to and from wintering grounds that encompass a relatively large area in the Bahama Islands. So, let's think about this. If we wanted to site a tower somewhere in the Carolinas, a region where Kirtland's Warblers are known migrate across during fall and spring migration each year, where would be the least hazardous site? We could use acoustic monitoring to try and map out a migration corridor for this species but the odds of detecting even one Kirtland's night flight call at any particular site seem quite small. And even if we did detect one, I think the chances would be exceedingly slim that we would ever detect another at that same site. With the vagaries of migration weather from year to year, Kirtland's Warblers may have a 200-300 mile east-west variance in their flight path from one year to the next. We don't have much information about how accurate they are during their migration, but considering what we do know based on diurnal sightings, it seems very unlikely that acoustic monitoring would be useful for tower siting in the migration route of this species.

Similarly, tower siting would not be a major issue on Kirtland's wintering grounds in the Bahamas because the species is known to be widely distributed over many islands. Any single tower would not have an effect on a significant proportion of the population. However, on their breeding grounds, a large proportion of the population nests in a very small area. I would suggest that it would not be a good idea to locate towers in close proximity to this concentrated breeding ground.

The impact of towers on Kirtland's Warbler populations will likely be somewhat proportional to the sheer number of towers across their range, especially their migration route. Certainly geographic features along their migration will concentrate migrants and therefore there will be some tower sites that are more hazardous than others. But weather conditions can concentrate migrants just about anywhere in eastern North America. So, we can generally say that the more towers there are, the more of a chance that Kirtland's Warblers will be killed. This leads me to conclude that the only way to reduce the impact of towers on Kirtland's Warbler is to make the towers safer. I believe research on tower lighting, with the goal of reducing the attraction to night migrating songbirds, is the best means to approach this problem.

Besides its applications for imaging broad front species composition and relative abundance, acoustic monitoring has proven to be a useful tool for monitoring avian activity in close proximity to towers. As I mentioned in my introduction, acoustic monitoring documented collisions and many incidences of alarm calls when a microphone was placed under a 317-foot tower in Nebraska. Also, in that study, call notes of migrating songbirds were recorded and the acoustic record indicates periods during some evenings when calling rates increase concurrently with call loudness. These appeared to have been incidences when songbirds were circling the lights on the tower.

Software has been developed to automatically log such call notes and the technology exists today to outfit towers with acoustic sensors that could transmit calling information to a research station. A researcher could simultaneously monitor hundreds of towers in a region for calling situations that indicate a kill might be taking place. This information could be used to alert field researchers to which towers to check in the morning. It could also be used to automatically monitor how many nights a year birds are congregating in the vicinity of towers, how often during a night, and roughly in what numbers. Such acoustic monitoring might also be used to trigger alternative lighting schemes that would be less attractive to migrating songbirds.

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Presentation Number 6

NEXRAD Doppler weather radar, other radar applications for bird monitoring

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Al Manville's introduction of the sixth conference speaker, Adam Kelly

Our next speaker is Adam Kelly who has been the manager of the U.S. Air Force 3rd Air Force Bird Control Unit from 1980-1992. He holds a Masters Degree in Conservation Biology from the University of Kent in England. Adam joined Geo-Marine, Inc. and has worked for them since 1994 to develop bird avoidance models for the U.S. Air Force. Currently he is upgrading an avian hazard advisory system for the Air Force; he has been doing that since 1995 and hopes to have it online nationwide by early 2001. Adam Kelly.

Adam Kelly

I wanted to start at the large scale with something that we call the Avian Hazard Advisory System, where we are using NEXRAD weather radar to look at bird migration across huge areas of ground. This is of interest to the Air Force because bird collisions with a military aircraft when it is training, doing 400-odd knots airspeed, usually leads to a lot of damage to the aircraft, particularly if the collisions is with a large bird. So the Air Force has a big interest about where and when those birds are moving. This work that we are doing builds upon some prior work by Ron Larkin who is here and who really is one of the first to look at automatically recognizing bird or biological targets in weather radar data. I need to mention Ron's work here because it really started this field off. But we took another approach to it. We wanted to eliminate the weather targets first, and then refine down to the biological targets – it's a little bit easier way to look for the needle in the haystack in some instances. And what we've done is use advances in computer technology since the mid-1980s, when Ron was doing a lot of his work, and use a satellite link to take all the data from the NEXRAD radar sites and bring it to one central location in Panama City, Florida, where we can analyze it.

These images are from the southeast United States – you don't see any map outline on there because it is just raw radar data [*reference to slide*]. But an image that will mean something to people who have looked at radar images before – these are sunspurs; this is taken at dawn as the sun comes up, this is the line where the electromagnetic radiation from the sun has been detected by each radar station, and the image on the other side has been automatically processed to remove that target type. By automatic target classification, we can now get to the point where we can turn weather on and off, turn off the sunspurs, etc., in the imagery and leave behind the biological targets. And all this is done in a GIS system.

When you have GIS-referenced datasets you have great capabilities for looking at and modeling the effects for the military – when they are likely to have a hazardous collision with a bird. But from this perspective, we can take weather data products, such as what is the visibility outside at any point and time, and overlay it with the radar imagery of where birds are migrating.

We use that to test our algorithms to see if we are successfully removing the weather from the data and leaving biological targets behind all the time. We are also using the weather data we receive through the satellite link to make predictions on when birds are going to migrate, and we actually match those up to the radar observations some 24 hours after we've made the predictions to see if they have held true. How could you use this? We could use this for monitoring and forecasting low visibility conditions -- something that's been suggested as a cause of high bird mortality at communications towers. If you can predict where the birds are, perhaps there are some mitigation measures that can be taken with changing lighting regimes especially in conditions where there may be high bird mortality (*e.g.*, low cloud ceilings). We can also use these datasets from a strategic standpoint of modeling to determine locations where we have lots of birds migrating. Southeastern United States is definitely an area where there are more days of bird migration and higher numbers coming through than say out west. Next, match these migration areas to low visibility conditions.

It's interesting that Todd Engstrom is here from the Tallahassee area. Tallahassee is well known in aviation circles for having the worst airport to fly into with respect to low visibility. There are regions of the country which historically have suffered from low visibility conditions. Being able to gather this weather data and match it to areas where we know there are concentrated migrations may highlight regions of the country where you should be more concerned about towerkill issues than others.

To measure this, simply look at the intensity of migration. You could probably pull up a good index of days such as an intensity of migration on specific days over a long period of time on a continental scale and do this across the entire United States. This could help us to answer the question of why the observed towerkills in the western U.S. are not as severe even when the towers are actually taller, which should theoretically be affecting more birds. My guess is that it has to do with the lower density of birds moving out west, but maybe the lack of low visibility weather conditions is also a factor. There are some techniques we can use within a GIS system. You saw where Bill Evans has shown with his acoustics research where you would likely have a species like Kirland's Warbler. You could then match that to radar imagery and start to interpret where sensitive species may be moving through the country.

In the big sense, these data may be used to cue research to hone in on where we have a prior history of towerkill characteristics. These characteristics include low visibility, tower location, and the use of more local studies to ground truth and get the detailed information on the ground. Ground truthing is one of the huge challenges in all remote sensing work on birds. You must have good quality ground truthing to make sense of these larger datasets. This, specifically, means measuring the numbers of birds that move. NEXRAD gives you 1 by 1 kilometer measurements of reflectivity which is proportional to the amount of moisture in the birds' bodies. But you actually have to physically be on the ground if you want to turn that into some measure of the individual number of birds.

Ron Larkin's work in the mid-1980s is a good example of how you go about calibrating that kind of imagery. With radar -- as Ron has outlined -- you can use it to assess the behavior of birds near the towers. I've put together a table of some of the commercial technologies. However, not all the ones that Ron has mentioned are included because some of them, like his tracking radar, are used military equipment which can be difficult to come by and can often be difficult to maintain over the long run because spare parts are a problem. Looking at my table, I've outlined technologies that are commercially available and likely reliable, including cost.

To review, let's run through some of the techniques that could be used for local ground truthing, starting with X-band vertical scanning radar. In the current issue of the *Wildlife Society Bulletin*, note the paper by Michael Morris which outlines this technique. It's relatively new in the last 3 years. Essentially you are taking a marine radar and flipping it on its side so it spins like a windmill, taking a nice vertical slice of the atmosphere. You can count bird targets crossing that line through the atmosphere. It also gives you altitude of the targets and the position that they are going across the ground.

You could actually image adjacent to a tower, have the tower within the image, and be able to see where the birds come through relative to it, and ground track vertical distribution. This would give you some very good data of the vertical distribution of the birds.

The S-band radar we have found incredibly useful. Pretty much everywhere the Air Force has had us working has been wetland areas, and we've found that X-band 3cm radar does not work well in a wetland environment with a lot of wet vegetation. The dampness tends to just eat up what we are transmitting out, and we never see any birds even if we are looking at them with a pair of binoculars or a spotting scope. At 10 cm we have had much greater success in a terrestrial environment. Where Ron Larkin was showing with a tracking radar that you can watch the tracks of birds coming in, the S-band radar gives us the capability of looking for birds that are coming in toward a tower and image them actually circling it.

Image intensification through night vision goggles is a pretty cheap technology currently available. Sid Gauthreaux outlined how he used those for his study. The problem: you have to amplify the ambient light or you have to provide a light. If, however, we are really interested in looking at these birds under low visibility conditions, night vision techniques do not work very well.

The next category down, thermal imagery (TI) -- also called forward looking infrared -- actually picks up the heat that is transmitted from the bird's body in the far region of the infrared spectrum. We have a camera -- unfortunately it costs about \$70,000 -- which will image a bird the size of a goose or a swan at about 2 miles in clouds and bad visibility. We have literally looked across a lake in fog and been able to tell that the bird was preening; the image is that detailed. You can also change the field of view of this system to actually look into a cloud. This could actually image birds flying in low visibility around a tower enabling assessments of bird behavioral responses. Care must be taken, however, in your scientific protocol to not over-interpret the imagery. Couple this work with the acoustics research Bill Evans has already outlined, combined that with some of the image processing techniques we are using on a larger scale where you automatically count and quantify bird targets going by, and you now have some really good techniques for actually measuring what's going on. You may also have some of the hypotheses as to the reasons for these towerkills.

**Presentation Number 6
in the workshop
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Presentation Number 7

Buildings, lights, findings applicable to towers, cumulative effects — the Canadian perspective

Michael Mesure

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Al Manville's introduction of the seventh speaker, Michael Mesure.

Our next speaker gives us an international perspective on the issue of lighting. From early childhood Michael had artistic talent which led one to conclude that a career as an artist was inevitable. There, however, was an underlying sign that this might not be the case mainly because of the subject matter he chose to draw: birds. As he grew up, his fascination with birds would reveal itself time and time again. In 1989, a close friend of Michael's mentioned that he had once read something about birds flying into windows at night. Michael, both fascinated and horrified by this statement, had to check it out and indeed discovered bird mortality in Toronto. In 1993 he formed the Fatal Light Awareness Program, also known as FLAP. In 1996 FLAP and the World Wildlife Fund of Canada came together and produced the document entitled *Collision Course: The Hazards of Lighted Structures and Windows to Migrating Birds*, and they've also come together to develop the Bird-Friendly Building Program. Our speaker this afternoon is the Founder and Executive Director of FLAP, Michael Mesure. He's going to be talking about buildings, lights, and findings applicable to towers, cumulative impacts, and the Canadian perspective. Michael.

Michael Mesure

What I thought I would do is share with you FLAP's experience in dealing with the corporate circle because you are very much going to have to deal with this with the communications companies. I think it's very important to remind yourself that, in spite of the fact that birds are colliding with these structures – communications towers, lighted high rises and so forth – that this was not the original intent of these structures to harm birds. It is really difficult, when you are finding bird mortality happening at individual structures across this entire continent, to calm yourself down when communicating with these people.

Just a little bit about FLAP. We are a volunteer-based organization. We have no real ornithological background other than our basic experiences in birding and self-research. So we are limited in our ability to conduct a controlled study. We are conducting a controlled study to a degree in that we collect birds around high rises around Toronto's financial district in the spring and fall on a yearly basis. So, eventually we want to get more people with a scientific background involved that can help us compile more accurate figures with the data we are collecting.

This is all too familiar a sight, you are looking at some 70 species of birds here. FLAP will encounter some 70 different species each year. FLAP first started in 1993. Our original activities were focused specifically on the lighted structures within major cities. We very quickly evolved into focusing on collisions with human-built structures. This is just a bit of statistical background. We encounter close to 2,000 dead birds each year within the financial district. That represents a very small percentage of the birds that are actually colliding within the financial district.

We have to take into consideration that there are ledges that the birds fall onto that we can't access, there's a tremendous amount of scavenging going on, and in some cases they are swept up by cleaning staff. We are only able to focus on less than a third of the actual core. So, when we compile all these variables, we can estimate that some 10,000 birds collide with the high-rises within Toronto alone.

Not to get it confused with daytime collisions, but inevitably this is part of what we are focusing on as well. This is interesting. When you are dealing with the corporate world, you are going to find that they are more than willing to help – the bottom line is the dollar figure. They don't want to spend hundreds of thousands of dollars in making the necessary changes, and this is where research needs to be done – ways that we can work with existing structures without spending a tremendous amount of money to make a difference.

We also offer the opportunity for a good corporate-citizen reputation. This image was in a double full-page article in the *Toronto Sun*, which is one of Toronto's largest newspapers. The day that the article came out I got a phone call from the Royal Bank of Canada and they said right off the top, "What do we do to stop birds from flying into our structure?" To tell you the truth, all we could say at that time was turn off your lights. We very quickly realized, here's an opportunity to work with a large corporation, to rack their brains on what they feel they can and can not do, and from that create a program, which hence became the Bird-Friendly Building program. But then when we sat in the meeting with them, it came out in the open why they called. It was this right here [slide shown], that's their logo – totally accidental. But they saw their logo associated with death and they didn't want to see that, and they wanted to do anything they could to make a change.

This is the Collisions Course report [slide shown] – *The Hazards of Lighted Structures and Windows to Migrating Birds*. I have a few copies of them up there if anyone is interested, and this is the Bird-Friendly Building Program. Now the Bird-Friendly Building Program a one pager which consists of 12 recommendations that we offer to buildings on how they can reduce lighting, or what we call – "control the escape of light" – from their structures without spending hundreds of thousands of dollars. We were going to call it the 12-step program but then that conjured up Alcohol Anonymous and we thought better not to do that. The bottom line is simple. At the flick of a switch they can save birds lives, but the tricky part is changing the habits of the people within these structures. Now obviously communications towers are to a degree a totally different situation – not dealing with tenants in the structures and so forth, but you are dealing with a corporate image, and it is so important that they get that positive reinforcement all the time.

This is the Bird-Friendly Building certificate [slide shown]. Any building that adopts the Bird-Friendly Building Program receives this certificate to hang on their wall. It's difficult to see, but there are 5 gold seals, and each year the participants are rated on their progress within the program. Then they receive a gold seal to stick on the certificate. It's amazing how effective these things are. It's a very competitive circle and they try very hard to out-do the next guy.

This is an example of what I do each spring and fall. I take photographs of some of the participating structures. Presently we now have about 100 buildings in the program. I only analyze 16, those being the tallest structures that take the most amount of birds. I show the management where they stand in the photograph – this is spring of 1997, obviously fall of 1997, and you can see right off the bat – a picture tells a thousand words [slide shown]. You have to maintain professionalism and communication with these people, and you must be persistent. You have to keep, for lack of a better phrase, "in their face" and just let them know you are not going to go away. It's amazing how much positive results this will stir up.

What we do with these structures is analyze them and put them in a graphic format from the most lit to the least lit structures. The people down here [least lit] – they love us. The people up here [most lit] – they hate us. This encourages competitiveness among the corporations because they all want to be down here [least lit]. As a result, for example, there's one structure, the bank of Montreal – the tallest office tower in Toronto – 72 stories in fact. They were lit an average of 48% in the spring of 1998. The fall of 1998 they were only 12% lit. That's a huge reduction. Believe me, I know – I count each and every little window and I go insane doing it, but the results are very effective.

This is the closest in the Toronto area to a communication tower scenario. This is the CN Tower. For years they spot-lit their structure. In fact, when they were first built they were called the world's tallest free-standing bird killer. They took a tremendous number of bird lives. Through public pressure combined and FLAP's activities – they now extinguish the spotlighting during the migration seasons. In fact, there are red strobe lights at the side from top to bottom, and then white strobe lights at the top. We find maybe a half dozen birds now at the base of that structure. I've been there when the spotlights were on at the beginning of the migration season. There have been hundreds of birds at the base of that structure, circling in the light, flying into the concrete and each other. When the lights go out on a timer at 1:00 am, the birds that remain in flight then fall to the ground. It's like their pupils have to adjust to the sudden darkness. Then one by one they start to disappear into the darkness. There's a question as to the variation in the red strobes and the white strobes, and how they truly do have an effect on nocturnal migratory birds.

Thank you.

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Presentation Number 8

Standardizing methods and metrics for quantifying avian fatalities at communication towers: Lessons from the windpower industry

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Al Manville's introduction of the eighth speaker, Paul Kerlinger.

Our next speaker is an environmental consultant and a principal with the firm of Curry and Kerlinger in New Jersey. He, among other things, works with the wind power industry. Paul Kerlinger is going to be speaking on the issue of standardizing methods and metrics for quantifying avian fatalities at communication towers and lessons from the wind power industry. Paul.

Paul Kerlinger

I was asked to speak to you today about some of the lessons we have learned in the wind power industry which has experienced problems and recognized those problems since the late 1980s. Specifically, I want to talk to you about the methods and metrics that are now being used to assess avian fatalities at wind turbines. Many of the lessons that have been learned are applicable to the communication tower industry and some of these techniques have also been used to assess fatalities at transmission wires and other such situations – tall buildings, etc. First of all you have to ask the question, why standard metrics and methods? Most of you here are scientists or are involved with environmental organizations so you can understand why we need to be able to compare or make some sorts of comparisons among different types of towers, different sites, different lighting conditions – so the first reason for establishing standard metrics and methods is comparability. We want to be able to make inferences. If you don't have that capability, you are out of luck.

For the first few years in the wind power industry, people were using many different metrics and methods and various studies were not comparable. Some people still complain that in that industry not all the studies are comparable. But we are rapidly working toward a time when we will be able to compare fatalities at one site with another – come up with methods for looking at that. We also need these comparative methods and metrics to evaluate various prevention and mitigation schemes, as well as looking at prosecution. Unfortunately, there is a legal issue here, as Al pointed out, so every time we collect birds it obviously raises the specter of litigation and prosecution.

Finally, we'd also like to be able to compare in a very statistically rigorous way the types of mortality at various types of structures – windows, other sources of mortality such as cats, highways, and wind turbines – with communications towers. So once we have estimates and methods and metrics that are comparable, we can achieve that. In the wind power industry there are only a few things that are generally agreed upon today. One metric and one set of methods are fairly well agreed upon. The first is the numbers of dead birds found per turbine per year.

So, in other words if you have a turbine out there, and if you can figure out how many birds per year it kills, then you can generalize. If you have a whole turbine field, you can average that out and you can compare it to other sites to find out what's actually going on. So that's one of the things that is generally agreed upon. However, I have to be careful what I say here because we have a couple of people here with the National Wind Coordinating Committee who are working on turbine kills as well. So, not all of us agree on all of these things, but generally these things we do agree on. And the actual method that we really agree on the best is the actual search methods – the area that is searched, the frequency of searches, and how we go about doing those searches.

Looking at the metrics, we are mostly talking about dependent variables – the use of those metrics we must establish first – in other words, what do we want to use the metric for. Obviously the most important thing is establishing impact. As far as impact goes, we can look at dead birds – this is obviously a legal issue as well. We can also look at behavior. There are many metrics and methods we can use to study different types of behaviors.

To recap, you may want to look at dead birds or at behavioral impacts. I should also mention that behavioral impacts are not subject to litigation unless they involve threatened or endangered species. That's one of the reasons you might want to separate those [dead birds v. behavior] and look at them for the larger species as well. You also want to take a look at documented fatalities, or the estimated numbers of fatalities at towers. The documented fatalities per turbine or per tower in the case of the communications industry would have implications for law enforcement, but for those of us who are also interested in conservation – in other words, preventing mortality or looking at population impacts – we want to look at the larger number. This larger number includes the birds that are not found for lack of 100% observer efficiency and because of scavenging (carcass removal). For example, when you find 10 birds out there it is likely that there were more out there because observer efficiency is not 100% and cats or skunks or raccoons or harriers or whatever may have removed those carcasses.

By using a standard metric in the tower industry, we might come up with a metric such as the number of birds killed per tower per unit of time. This unit of time may not be per year but in some cases may be per evening depending upon the statistical analyses you wish to use. You also have to consider things like species-specific fatality rates. The reason you need to consider this is that you may have 100 or 200 or 1,000 birds at a tower. As one of the earlier speakers pointed out, this is a skewed distribution. Certain species are more subject to fatality. So, separating out those hundreds or dozens of birds into species-specific entities and coming up with your numbers of, for example, Redstarts per tower per year would be very helpful as far as population impacts because the population impacts obviously are related to specific entities. It is also important to use standard metrics. Within the tower industry, we are going to have to come up with independent variables that are standardized such as the lighting, the guy wires, tower height, location (*e.g.*, geography and topography), where you put these towers, and be able to compare these independent variables. We also need to look at various mitigation or prevention techniques. You must have some means for comparing those things.

As far as fatality search methods are concerned, I think most of us agree that the methods are fairly standardized now in the wind power industry. As far as time or frequency, and the number of searches, it is much different from the studies you heard before regarding the Florida Tall Timbers television tower. In the wind power industry, we generally look for larger carcasses because many of the birds involved are raptors – species like Red-tailed Hawks seem to be more susceptible as are Golden Eagles. They also remain on the ground a much longer periods. So searches on the order of one month versus every day in the case of small birds – nocturnal migrants – are used. The area searched should be determined by the height of the tower. In the wind power industry we search areas with a radius of about 50-60 meters from the tower. This is probably a larger area than we used to search because turbines previously were smaller. Now the turbines are poking through 76 meters (250 feet) above ground level. We are going to have to look at a larger area to evaluate if we are finding a high proportion of the carcasses. But just to let you know, most of the carcasses fall within about 35-40 meters of the bottom of turbines. Those, again, are primarily large carcasses.

We agree pretty much on carcass removal and scavenging studies – the types of studies that need to be done. Earlier studies relied on using chickens which seemed to taste better than some of the real birds that were put out. So researchers are now using actual specimens of Red-tails, Red-winged Blackbirds, or whatever other specimens are available so that there is an element of reality in the carcass removal studies. You may have anything from carrion beetles burying warblers and woodpeckers, to even a Red-tailed Hawk removing a larger carcass. This is extremely variable as is searcher efficiency. This precludes the use of dogs, which some people are talking about right now, which may be much more efficient and effective than humans, and they are also cheaper to operate. We pretty much agree on this in the wind power industry, although things are changing because there has been an evolution to taller turbines and bigger machines, and there has also been an evolution to smaller numbers of turbines at a given site. So there are all sorts of things going on now.

As far as behavioral methods, I probably shouldn't even get into this, because you've heard many experts earlier talk about radar, infrared techniques, ceilometer techniques, acoustical techniques, and others. But behavioral methods are important for both a basic and applied sense here. I admonish you to be careful about panaceas. Many times these techniques will have to be used together. We are arguing still in the wind power industry on what techniques can be used when. And I guess this is no different from any other academic endeavor where very few people agree. And also again, it raises the specter of legal versus conservation issues. Dead birds versus behavior – do you have to really worry that much about behavior. But without being able to measure behavior and coming up with standard metrics like the curving of flight paths in response to lights that we heard about before, you really can't evaluate what the impacts some of these lights have on behavior that may lead to fatality.

It is difficult to generalize from the wind turbine industry to the communication tower industry because the types of birds that are impacted are different. Wind turbines impact diurnal birds which frequently are raptors, although others may be involved. In the communication tower industry, most of the birds impacted seem to be nocturnal migrants. So far nocturnal migrants have not shown up in large numbers among the towerkills at wind turbines, primarily because the wind turbines are much shorter than the tall communication towers.

There is a document about to be published in the wind power industry and one of its authors is in our audience, Dale Strickland. It has been reviewed many times. To determine when and how we should establish standard metrics and methods, I think it is important to emphasize that right now is the time to get those methods established because over the past 10 years in the wind power industry, I think we have found ourselves behind where we could now be – we could have learned a lot more if we had agreed on some of those metrics and methods. One of the ideas that came out of the wind power industry was to establish a committee, and that committee is to put together a document called the methods and metrics document. I urge you to keep any methods and metrics documents for this industry very simple. If you put this committee together you will need to bring in various stakeholders including the industry, academics, conservation organizations, and finally the agencies that regulate these birds. Put that together, get those stakeholders together, and establish what metrics and methods you want to see used. We have actually been doing that over the past 5-6 years, and have had fun in the process. The methods and metrics document, as Dale painfully knows, is on its seventh draft. Parts of it are very very technical. I'm not sure how many people are going to want to read some of those chapters. But there is some very valuable information in that document that is applicable.

The last thing Al wanted me to mention, are there any standard practices for reducing risks in the wind power industry that are applicable to the communication tower industry? There are some, however not all of us agree on what they may be, or how important they may be. But the first and most important, I believe as Bill Evans was also saying, is location – where you put your towers is very very important. I think that this is going to be a much more difficult situation for nocturnal migrants, especially with these tall communications towers, than it is in the wind power industry, primarily because the types and numbers of birds that are impacted by wind generators are raptors, and in very specific locations where raptors are foraging.

Any of you in the wind power industry can correct me if I'm wrong, but nocturnal migrants simply have not been implicated in the kill list for wind generators that often. The other things that can be done include site layout; some of us have been involved in laying out sites where Golden Eagles or other birds are foraging. You keep these turbines off the steep slopes where these birds are soaring. Finally, avoid lattice-type structures for wind turbines which will allow birds to perch. By allowing perching sites, though perching sites may not be directly related to mortality, if you have 20 turbines out there in a wind farm, you have lots and lots of perch sites that keep birds in – especially raptors – or bring them to the site, where eventually they might be killed.

These are some of the lessons we've learned from the wind power industry. Good luck with this effort.

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Scientific Panel Summary

Al Manville's introduction of our ninth speaker, Sidney Gauthreaux.

Sidney Gauthreaux, who spoke earlier this afternoon on this panel, is going to provide a summary of what was presented in Panel 1. Sid.

Sidney Gauthreaux, Summary of Scientific Session, Panel 1 Presentations.

Just a few comments in the way of synthesizing the first panel's presentations. Three presentations by Todd Engstrom, Ron Larkin, and myself emphasize how little work is out there in terms of the actual data we have been able to gather in a systematic way. Three panelists talked about techniques. Bill Evans, of course, with the acoustical aspects; Adam Kelly, with an overview of radar techniques that may be able to bear on the problem; and Paul Kerlinger talking about an incredibly important aspect – metrics – as part of the whole methodology of doing studies. I mentioned in my study metrics problems and others have done so too. Bob Beason addressed an issue that a lot of people don't have the time or the expertise to pay attention to, and that is understanding the fundamental physiology of birds that might contribute to this pattern. We can't put too much emphasis on simply looking at what they are doing and so forth. Some of this work is going to have to go into the laboratory and we are going to have to do basic research, not applied research. And finally, Michael Mesure pointed out that in terms of stakeholders, those stakeholders may be far more abundant than we think initially. There are corporations out there, be they cell phone companies, telecommunications companies, or banks in tall buildings that would like to contribute some understanding to the problem and certainly some solution to that problem as well. Michael, I wonder how expensive it would be to put shades on windows at night in some of these tall Toronto buildings? It seems like a rather ridiculously simple solution, and perhaps not terribly costly. So, in overview this afternoon, I think we have set the stage for Panel 2 which is going to show some follow-up effort and get more into the litigation perhaps, and some of the problems associated with enforcement.

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Presentation Number 10

Licensing concerns, NEPA, sitings, Telecommunications Act mandates - the FCC perspective

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Al Manville's introduction of the tenth speaker, Holly Berland.

Our first speaker on the second panel is going to be speaking from the back of the room because she unfortunately sprained her ankle here in the last few hours. It's a little easier for her to speak from the back and she does have a portable mike. Holly Berland is a staff attorney with the FCC's Office of General Counsel; she has been with that office since 1984. Her responsibilities have included, among other things, providing advice on environmental, personnel, fee, and tort issues. Before joining the Office of General Counsel, she worked in the FCC's Mass Media Bureau. She's worked in Enforcement and also with the Policy and Rules Division. Holly Berland is going to talk about licensing concerns, NEPA, sitings, and Telecommunication Act mandates – the FCC perspective. Holly.

Holly Berland

Let me begin by telling you that the FCC began in 1927 with the Radio Act. It came about because everybody was broadcasting from Uncle Sam to your Aunt Millie, and as a result there was a lot of interference and no voices were heard. So, they created the FCC as a spectrum management agency. Our statutory mandate is to insure and foster an efficient and nationwide telecommunications network. We are a licensing agency, we are not a land planning agency. Indeed, the FCC does not even have an environmental office for review. We do not get involved in our licensees initial planning or construction phases. We don't have the resources to investigate or monitor sites. But as a Federal agency, we do have environmental responsibilities under NEPA and other various statutes such as the Endangered Species Act.

What the FCC does is delegate our environmental responsibilities to our licensees and our applicants. Mainly, because the FCC as a licensing agency, not involved in our licensees initial planning stages, has a multitude of licenses for various services at a multitude of sites throughout the country and we just simply do not have the resources. So basically our applicants and licensees look to our environmental rules, primarily Section 1.1307 and kind of check off whether this particular site may affect historic sites, could it affect endangered species, would it involve white strobe lights. There are various factors. Migratory birds are not listed under 1.1307. Under Section 1.1307(c) of the FCC's environmental rules we have a safeguard provision. That safeguard provision provides where the Agency is provided with detailed specific information that a particular site may have an adverse effect on the environment, the Agency may require the licensee or applicant to prepare an Environmental Assessment and undergo environmental review prior to construction. Under that safeguard provision, the Agency has on occasion taken into account the effect of particular towers on the migratory bird population.

In other words, our environmental rules today do not require the routine consideration and assessment of towers' impact on migratory bird populations. Any change in the environmental processing requirements at the Agency would obviously require a rule-making proceeding.

The agency also, under Section 303(q) of the Telecommunications Act, is authorized to require tower owners to place specific lighting and painting and marking requirements for the purposes of air navigation safety. To implement that section of the Telecommunications Act, the Agency has recently initiated an antenna registration system, which basically requires any tower owner with a tower of over 200-feet, or within close proximity to an airport, to go to FAA and get FAA approval, and then come to the Agency and register their tower. To insure that environmental considerations are taken into account at the initial planning stages, we require the tower owner to also assess whether that particular tower would have an impact as defined under the [Federal Communication] Commission's environmental rules.

I've talked to some people in our support survey group who are responsible for the antenna registration program. From what I understand, the tower lighting requirements vary and the costs vary depending on the size of the tower, the type of lighting involved – strobe lighting, white lighting apparently could be very costly and could range anywhere up to \$150,000 per tower. Any changes in the requirements would obviously require FAA collaboration, because air safety is one of the primary responsibilities and is specifically set out in 303(q) as one of our responsibilities. The impact of towers on the migratory bird populations is a relatively new issue; Commission staff and Enforcement staff are becoming aware of it. We've received several complaints on specific towers, but we have not really received any studies, any scientific basis or justification to require or consider revising our rules at this time. The FCC staff is obviously interested. We've appeared at several interagency and industry meetings in recent months, and it's under review but the Commission has not addressed the issue other than in specific instances where we have been shown that a specific tower may or may not have an impact on migratory birds.

I'm not going to leave you with the impression that we've imposed mitigation measures on hundreds of towers because we haven't. We haven't been given that data or information. I would say in a handful of cases, we have considered the impact of our towers on birds because we have been given specific detailed information in those instances. We are interested, and that's why we are here. Thank you.

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in the workshop
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Presentation Number 11

Obstruction marking (lights) — recommendations from the FAA

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Al Manville's introduction of the eleventh speaker, Dave Bayley.

Our speaker is Acting Manager of the Air Space Branch, New England Regional Office of the Federal Aviation Administration. He did his undergraduate work at Kenyon College, graduate work at Pennsylvania State University, and served in the Air Force working on NORAD issues – stationed in Great Falls, MT; Syracuse, NY; and in Iceland. He has been with the FAA since 1975. Our speaker has been an air route traffic control center specialist, and he's been a flight service station specialist – which is good news to me because that is where I get some of my weather flight information from. He has worked at control towers in a number of locations. He is currently assigned to the FAA's New England Regional Office Obstruction Evaluation Program. David Bayley is going to be talking about the issues dealing with obstruction marking, lights, and recommendations from the FAA. Dave.

Dave Bayley

The FAA is set up to work with other agencies, but specifically, the way we work is that a proponent with a tower or any kind of structure will notify the FAA and Part 77 of the Code of Federal Regulations describes that process for people to notify the FAA concerning buildings and towers. It's important to note that dealing with buildings and towers simply requires a notification procedure. When we talk about the FAA authorizing a tower it is kind of a misnomer. We don't really authorize or approve towers like the FCC who licenses them. We merely look at them and do an aeronautical study. The aeronautical study is based on navigable air space which we define as starting about 200-feet above the surface, above ground level, and all the way up to 60,000-feet – beyond that we don't really care. The military does things up there that we're not going to focus on. And I don't think that's the focus of this group.

At 200-feet, there are some other surfaces where we go right down to the surface of the airport, and what I try to do is put up that to illustrate where we are looking at close proximity to an airport, there may be towers or structures that are only 50 or 60 feet high that we would insist be marked for visibility to pilots that are operating in and near that airport [*reference to overhead*]. These Part 77 surfaces are described in an advisory circular that is available on our website on the internet, and it is just to describe a series of slopes where aircraft are maneuvering toward the airport.

When we do an aeronautical study we do an initial screening just to see what it is that the tower is going to do to our navigable air space, since we try to provide for safe and efficient use of that air space. We share that air space with all the other users. We'll look at it and if this particular structure penetrates one of these surfaces, we'll do a further aeronautical study. Generally what we'll do is gather information from aviation user groups.

The thing you have to understand is we are under a great deal of pressure to make these towers and obstructions as conspicuous as possible to pilots – not inconspicuous. When I hear people talking about turning lights off I get very nervous. We accept comments pertinent to the aviation aspects of the obstruction and once we finish our study, we make recommendations for what we call marking and lighting. Marking is simply something we use for, I'm going to use a term here – “conspicuity.” I'm not sure it's a real word but it is one we use a lot in the agency. We try to make these things conspicuous during the daytime, and what you are talking about in the night-time is lighting.

For lighting, we look at different schemes. You've seen pictures of both white strobes and red lighting – particularly the case in Charleston, SC, where the two are located in close proximity. As Holly mentioned, when a proponent comes to us and requests certain lighting, they have overriding economic concerns that they are dealing with. We have concerns from an aviation safety point – the environmental concerns are not really considered. And when people ask about the environmental aspects, as Holly alluded to, it is not a Federal action so per say it doesn't fall under the guidelines of NEPA – all we are doing is looking at it from the standpoint of making it conspicuous. The environmental concerns that we most often hear regarding towers are the effect of the lights on neighbors. We have had cases where people have complained about flashing white strobes. Proponents have then come to us and said can we paint the tower orange and white and put on red lights – and this is considered a suitable alternative in most cases and we will honor that request, considering the neighborhood. We've had other cases where people have asked to not mark and light an obstruction, and we've insisted that it be marked and lighted. And, we've other cases where we've said you don't have to mark and light the obstruction, but because a town thinks you should have a red light on it, they put a red light on it and this has happened in cases where we've had cell towers of less than 200 feet. We have no legal standing.

It's important to understand that the FAA merely does an aeronautical study and makes a recommendation on the basis of that aeronautical study. We have no regulatory authority over that navigable air space, as incredible as that may seem. What we do with our aeronautical study is make a determination as to whether this obstruction is a hazard to aviation, or a determination of no hazard – and in the case of a hazard, we can't even stop the construction of that particular tower or building. In the case of the FCC we depend on that agency to not license and radiate a signal because we have made a determination that it's a hazard to aviation and to date, they've been very good about honoring those recommendations based on the fact that it may be a hazard. But as I've said, we don't regulate those towers – all we do is make a determination.

To make those towers more conspicuous to pilots, we do make a recommendation often times for orange and white paint or red lights. I can't tell you honestly what it's been based on. I know there were a number of studies that have been done in the past, and that was deemed to be one of the more conspicuous patterns to make these things obvious to pilots. Lately we've come up with dual lighting which is flashing white lights during the daytime to make them conspicuous, and red lights at night. That seems to be a preferred alternative by some operators, and then the high intensity or medium intensity strobes are very expensive, but we would recommend those in cases where we have very large towers that we want to make as conspicuous as possible. With the advent of digital television, I would anticipate probably more of those lighting schemes because nobody wants to go up 1,000 feet or higher to paint a tower. When you use the high intensity white lights you obviate the need for painting that tower. So, you'll probably see more of those as the telecommunications industry goes to digital television which they are mandated to do by Congress.

If you get the idea that there are some conflicting mandates here you are probably absolutely correct. As I said our mandate is the safe and efficient use of the air space. We do what we can to protect the pilots. The idea that avian mortality might enter into that has not been something that the FAA has looked at in any detail to the best of my knowledge. When Reggie Mathews talked to me – I think he participated in June in a [RESOLVE] seminar – this was fairly new information to us in this area.

So, I guess what I would like to say is there are some options with lighting. There are some options for dual lighting or white lighting or red lighting, but all we can do is recommend. We can't insist other than in those areas where we think that something may be needed to be lighted to be more conspicuous – we would insist. But often times we just accede to the needs of the proponent for their economic purposes, that's what they'll come to us for. Or, if they're getting pressure from an environmental group, usually because of the lights at night or something, or for some other reason. But we are not the ones who are making the decision based on any environmental grounds. That's something that comes about in other ways. The real people who regulate towers are your local communities and your states. The FAA does not regulate those towers. If it gets too close to an airport we don't like it – but that is all we can say is we don't like it. Often this is where it will end because the person would have a very difficult time getting insurance or carrying out business if they needed an FCC license. So, I guess what I would like to say as far as the aeronautical study process goes, we do not regulate. All we do is study and make a determination. I heard a suggestion that for study purposes that it might be possible to configure towers with alternative lighting. I can't promise anything but I certainly don't think that would be a problem as long as it would remain conspicuous. I don't think that we've done studies recently on what makes a tower conspicuous, and certainly any research into avian mortality with respect to communication towers should take into account probably not only the avian population, but the aviation population as well. The two things would have to work hand in hand. I'd just like close by saying that we are not entirely insensitive to the environmental issues here. They are new to us, but I think that the thing you have to consider is that where there's an environmental concern we'll look at it – but it is our mandate, it is our mission to provide the most efficient and safest air system in the world. And that is what we'll operate to do. Where there is room to maneuver, where there is room to work with the scientific community, I think that the FAA would surely do that to everybody's benefit, not just to one group or the other. Thank you.

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Presentation Number 12

FCC permitting, NEPA, endangered species, refuge issues: the role of the Fish and Wildlife Service

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Al Manville's introduction of the twelfth speaker, Robert Willis.

I indicated earlier that my Agency has several different mandates as far as towers are concerned and our next speaker is going to address one of those concerns from the Service's Division of Habitat Conservation perspective. Robert Willis did his undergraduate work at Auburn University and graduate work at Louisiana State University. He holds a Masters in wildlife management. He's been a wildlife biologist with the Louisiana Wildlife and Fisheries Commission and the Kentucky Department of Fish and Wildlife Resources where he was Chief of Surveys in Kentucky for five years. He joined the FWS in 1980 and most recently he has been in Anchorage, Alaska, for the past seven years working on the subsistence management program. He just recently – within the last couple of months – came to work in our headquarters office in Arlington, Virginia. Robert is going to be talking about permitting, NEPA, endangered species, refuge issues, and the role of the FWS. Robert.

Robert Willis

The Service has several mandates which require our involvement in matters dealing with migratory birds. All of them revolve around our primary mission, which is working with other people to conserve and enhance fish and wildlife resources for the benefit of the American public. We've become involved in evaluating the impacts of towers on birds through several avenues. The National Environmental Policy Act, Section 1503.4, provides a duty for the Service to comment on Federally licensed activities by stating that agencies which have jurisdiction by law, or which have special expertise which would be of benefit to the licensing agency, must provide comments to the licensing agency. That brings the Service in through the Migratory Bird Treaty Act, which gives us jurisdiction by law, and also through special expertise, since we are the migratory bird management agency of the Federal government. Another section of the National Environmental Policy Act provides an opportunity for the Service to be a cooperating agency in evaluating Federally licensed activities. Typically, this is done at the request of the lead agency when they are dealing with a Federally licensed or Federally funded activity which may affect fish and wildlife. We also have the option to invite ourselves in if we feel that we need to be involved and the lead agency has not seen fit to invite us.

There is an additional opportunity to become involved with the construction of towers when they are located on what the NEPA defines as a Federally licensed wildlife preserve. In the case of the Service, this would be a National Wildlife Refuge. The Refuge Improvement Act of 1997, which was an update of the 1966 Act, requires a compatibility study prior to any type of construction on refuge lands. Construction of a communications tower would have to be consistent with the purposes and the mission of the refuge before it would be permitted.

That determination is made by the refuge manager. Finally, the Service is involved through the Endangered Species Act. If construction of a tower may affect an endangered or threatened species or its habitat, the applicant for a Federal license must contact the Service.

The Federal Communications Commission regulations for construction of communication towers list eight circumstances where an applicant must provide environmental information prior to constructing a tower. Only 2 of the 8 involve the Fish and Wildlife Service: when endangered or threatened species or their habitats may be impacted, or when they are proposed for construction on National Wildlife Refuge lands. The FCC representative mentioned earlier that the FCC's procedure is to pass on to the applicant for a license the responsibility for determining if an environmental assessment is required for a tower that they plan to construct. The applicants generally pass the responsibility on to their tower contractor. For towers that are to be located on refuges, this is not a problem, since the refuge manager will be directly involved and will make a recommendation on whether or not the license should be granted. On non-refuge lands, the system tends to break down.

The applicant or contractor is unlikely to voluntarily say that they need to do an environmental assessment unless required by law to do so, as this can increase the expense and time required for construction. Except in the case of an endangered or threatened species, there is no requirement in regulation for any type of environmental analysis prior to tower construction. In most cases the tower contractor or their environmental consultant sends a request to the closest Service field office for information on endangered and threatened species and habitats in the area. The Service provides that information to the extent of our knowledge. However, at the current rate of over 5,000 towers per year being constructed, our personnel cannot visit every site and do an inspection of each project. Upon receiving the information, the contractor is under no obligation to comply with Service recommendations or even acknowledge their receipt.

If the Service office sees an environmental problem with a tower, they must document the problem and present the information to the FCC with a request that the license not be granted or the permit be modified. This is one of the points of contention that the Service has with the current FCC interpretation of the regulations. The fact that the FCC is two steps removed from the person who is making the decision on whether or not an environmental assessment is necessary, leads to far fewer assessments being done, and far less response to comments on the siting and construction of towers than we feel are necessary.

Migratory birds are not specifically mentioned in FCC regulations as requiring an environmental assessment, and are thus considered to be categorically excluded from this requirement. Categorical exclusion means that a determination has been made that there is no direct or cumulative impact to the human environment. The Service believes that the large number of towers that already exist probably does constitute a cumulative impact on migratory birds, and with the proliferation of towers that is expected over the next decade or so, that impact is going to increase exponentially. The Service has efforts underway with the FCC, the communications industry, and the Council on Environmental Quality to try to come to grips with this issue. The Service feels that cumulative impacts are already significant and are probably going to become more significant, and unless the problem is recognized nationally, there is little likelihood of getting the funding for the research that is needed to determine how to make towers more bird-friendly. That is the thrust of the Habitat Conservation Division of the Service at present – to try to get some national recognition of this problem and some nationwide research to address it.

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Presentation Number 13

Communication towers, avian mortality, and research needs

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Al Manville's introduction of the thirteenth speaker, Joe Meyers.

You probably remember not too many years ago that the research arm of several of our agencies – including the Fish and Wildlife Service and the National Park Service – was within one department but had separate research responsibilities. This was the National Biological Survey. That has changed a bit from the NBS and is now the Biological Resources Division of the U.S. Geological Survey. Our next speaker is station leader for the USGS Patuxent Wildlife Research Center in Athens, Georgia. He is an Adjunct Assistant Professor and graduate faculty member of the University of Georgia as well. His research interest includes Nearctic-Neotropical migratory birds, wetland and forest ecology, forest management, bird habitats, and endangered species. He holds a Ph.D. in ecology from the University of Georgia and he is a Certified Wildlife Biologist. Joe Meyers is going to be talking this afternoon about the issue of communications towers, avian mortality and research needs: recommendations from the USGS Biological Resources Division. Joe.

Joe Meyers_

I haven't done research on this topic as you might have noticed in my abstract, but quite sometime ago, when I was a student, I opened a large chest freezer at The University of Georgia – it was about 1976, I believe. That entire chest was filled with tower-killed birds from the Tallahassee study. I believe there were two chests full of dead birds, and that made a pretty significant impression on me and led me to look up every article I could find on that subject. Since I knew Bobby Crawford from Tall Timbers [Research Station], I read his papers. That, however, was the end of the subject for some time. While it was a good topic to read and research because when your major professor has that many birds in freezers, one might assume there to be a question on your orals, it never, however, came up again until about 18 months ago when I was called and e-mailed with what seemed to be a crisis atmosphere at FWS. Biologists wanted to know all kinds of information on the subject and it led me to this meeting. Ever since then, I've been talking with the biologists. I'm mostly a listener; that's my job to listen to my partners and see what their needs are, and they said they're having to make a lot of decisions without information. So, this presentation is based on those discussions and listening sessions and also on some of my ideas.

Foremost, we need to be studying the high towers, especially if we are going to be building a lot more of them for digital TV. These towers have the greatest potential to cause large mortalities for migrating birds. The tower lighting, guy wires, height, and tower location are important in this research, we know that.

These studies have to be done using well designed statistical methods that provide information for the entire United States and they must have the power to test for differences, because if they don't, we will have lots of samples with large confidence intervals or with lots of zeros that provide us with no information.

The other things we need to look at, and it's something I started looking for in newspapers, is the problem that a FWS biologist told me about concerning the permitting and building of cell towers. Biologists need information; they don't know what to recommend for cell tower permits. I asked myself, where are they building these towers? I started looking along the highways when I traveled to my field work the last two summers and I noticed there are a lot of towers on the interstate highways. This didn't seem to be much of a problem for migrating birds, but then I started thinking that there are interstate highway corridors along ridges for long distances north and south. There is one right near here (in Ithaca, New York). I-81 and I-77 go through the Shenandoah Valley and Appalachian Mountains for more than 1,000 miles. So, those areas may be important future research topics, because the towers on those ridges may be significant mortality factors for raptors and other avian species, especially if they are lighted. I didn't even realize until I came to this meeting that 200-foot towers are lighted now.

Another topic I believe is important, based on my discussions in the last 18 months, is to determine minimum sample sizes we need to standardize all the studies that we do; we'll have to work together with our partners and with industry. I do believe very strongly that pure science should be done on this problem and there should be a lot of research done on what is causing the birds' behaviors in regard to tower mortalities. But in the near future, the biologists need an answer, and we should give them research information as soon as we can get it to them. It might be an approach that we call adaptive management in the FWS and USGS, where we do studies based on information over time and then modify the hypotheses as new information becomes available. I believe that would be an important approach. What are the tower effects on bird nesting colonies? Right now I don't believe, except for eagles, that there is really good research information on how high and how far away from a bird nesting colony you can place these towers, for example, for a Wood Stork nesting colony – a Federally listed endangered species. This issue is coming up along I-95 right now in Georgia. Towers are being built. There are Wood Stork nesting colonies nearby. We have no information on the effects of those towers and how far they should be from nesting colonies. I've done a lot of flying with Wood Storks, observing them from small aircraft. They do get rather low at times while gliding; they also soar and may collide with a tower, but we don't have the research necessary to make decisions for safe tower placement for Wood Stork nesting colonies.

Lastly, we should determine the potential mechanisms of bird migration and navigation and that's where some of the pure science can help. This isn't easy. I heard a lot of statements here today about hypotheses, hypotheses, hypotheses. I recently read a book by Dr. Carl Sagan and his wife. They mentioned hypothesis generation and also mentioned the distant cousin of Charles Darwin, who was great at developing hypotheses, but wasn't great at the tedious work and effort needed to test them. And I think the communication tower and bird mortality problem is going to involve a lot of tedious work, so be prepared.

As the USGS Biological Research representative, I'll tell you that we are available and have the expertise at Patuxent and other centers to collaborate, participate, and cooperate with our partners and with industry on this problem, but we also are subject to the availability of funds and other resources.

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Presentation Number 14

The Wireless Industry Perspective

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Al Manville's introduction of the fourteenth speaker, Sheldon Moss.

Our next speaker is Director of Government Relations for wireless infrastructure issues with the Personal Communications Industry Association (PCIA). He directs the Association's efforts on behalf of the wireless carriers and antenna site managers. He deals with land use planning, work place safety, radio-frequency regulation compliance, and other facilities management issues. He also manages the elected Leadership Council of PCIA's Site Owners and Managers Alliance. Before joining PCIA our speaker worked in government relations with the American Feed Industry Association and he has managed issues dealing with animal health, livestock production, veterinary pharmaceutical issues, and he's also managed a diversified cattle and crop operation in Virginia's Shenandoah Valley. He holds an undergraduate degree from Montana State University and a graduate degree from Strayer University. Sheldon Moss is going to be talking about the wireless industry perspective. Sheldon.

Sheldon Moss

As Al mentioned, the Personal Communications Industry Association is a broad-based organization and we represent providers of wireless phone services, paging and wireless messenger services, and also companies that manage multi-use communications facilities. These facilities are the towers and other structures that the industry uses for transmitting and receiving their radio signals. The companies that manage many of these towers and wireless facilities specialize in co-location, where one and sometimes multiple service providers share a single structure or building to place their antennas, switches, and equipment. This substantially reduces the number of facilities necessary for providing wireless and mobile services.

We very much appreciate the opportunity to participate in this session. We also look forward to hearing from the ornithological scientists and learning more about this issue.

Let me quickly reference a body of law that we believe has a bearing on this discussion. This is the 1996 Telecommunications Act, where Congress determined that a competitive communications environment best serves the needs of all Americans and that the older monopoly-based model of telecommunications was no longer viable from the standpoint of serving the national interest. A competitive telecommunications environment is one where multiple service providers compete for the privilege of serving their customers in the marketplace. This requires providers of telecommunications services to develop independent and redundant telecommunications networks. As Holly Berland from the FCC just noted, Congress has mandated that the development of a state-of-the-art national telecommunications infrastructure is in the interest of all Americans and is a national priority. Putting this infrastructure in place will require laying many thousands of miles of copper cable and fiber optics as well as developing the facilities necessary to make optimal use of the radio spectrum.

Towers and other structures form the platform for providing a wide and diverse array of communications services. They include broadcast television and radio, cellular and personal communications services (PCS) – the new generation of digital voice services, paging, and text messaging and email, advanced iterations of traditional paging or “beeper” service. Communications towers are also necessary for providing a platform for fixed broadband services, which will provide a less expensive alternative to the copper and fiber-based networks for high speed data and Internet services. They are also needed for “wireless local loop,” which will provide residential customers a competitive option to their local phone company. These advanced services in the next few years will provide direct competition to your local telephone and cable television companies, who have grown fat and complacent by virtue of the monopoly status they have long enjoyed.

Businesses and government agencies also rely on these towers for their own in-house communications systems – including dispatch or two-way radio communications as well as more sophisticated voice and data networks. Finally, towers are essential for public safety communications. Law enforcement agencies, ambulance and other emergency services must have dependable state-of-the-art mobile communications systems. In fact, Federal law will soon require that a wireless network have the capacity to identify the specific location of a caller who has placed a 9-1-1 call from a wireless phone. Law enforcement officials and emergency management officials point to the tremendous property and lifesaving features that these new technologies will provide.

A fundamental mission of our Association is to help expedite the development of what we call “anytime, anywhere” communications. We recognize that we are in the midst of a telecommunications revolution in which all Americans have a personal stake. Whether you are a business user or a consumer, this revolution will mean lower prices, more choices, superior services, and enhanced efficiency in all areas of business. The future prosperity of our nation hinges in part on how well our country makes access to advanced and affordable telecommunications services to all Americans. I realize I probably sound a little bit like a commercial, but this is an important point that needs to be made.

In looking ahead, more towers are needed and not all of them can be built to be under 200-feet – the point at which aviation hazard lighting becomes mandatory. This is because, in order to operate effectively, many broadcast and wireless services must have antennas placed at points higher than 200 feet above the ground. Other factors often come into play. For instance, different types of wireless services have different technical and engineering requirements. Considerations such as the population density in the service area, the propagation characteristics of radio signals at different frequencies on the radio spectrum, and the service area that must be served in relation to the larger network come into play. Simply put, it is not feasible for all new towers of the future be built under 200-feet.

At the same time, our analysis indicates that only a very small proportion of new towers are actually going to be over 200-feet and require aviation hazard lighting. Assuming the estimated number of 80,000 towers in the United States over 200 feet in height is reliable, we estimate that over the next 5 to 7 years, the total increase in these taller structures will only be 4 to 6%. The overwhelming majority of new towers will be under 200 feet and will not require aviation hazard lighting.

Looking ahead, the wireless industry is committed to minimizing both the number and the overall impact of new towers. The industry is committed to co-location, where multiple carriers place their equipment on the same facility. Whenever possible, service providers locate their base stations or antennas on existing structures – not just towers but also office buildings, apartment buildings, and water tanks. The management of these towers is becoming more efficient and sophisticated and has given rise to the development of an important subset of the wireless industry – the tower and site management industry.

We concur with earlier statements made at this meeting by the FCC and the FAA that the concerns raised about bird strikes on communications towers have only recently been brought to our attention.

If you contacted the companies that manage hundreds or thousands of towers across the country, no one, from the CEO to the senior executives to the people in the field would be aware that some consider bird strikes a problem. I assure you, however, based on our involvement with this workshop and the efforts of Bill Evans and the U.S. Fish and Wildlife Service, that the wireless industry will be much more sensitive to these concerns.

In terms of working towards a solution, PCIA also agrees with what a number of people have said here today, that we need to determine the true scope and extent of the problem. We also believe if a problem is shown to exist, there should be some reliable indication that proposed remedies be commensurate with the scope of the problem. Heavy-handed regulations will not help bring about the telecommunications revolution in which all Americans have a stake.

We are also interested in determining whether collisions with lighted buildings might pose a greater threat to protected bird populations than collisions with broadcast and communications towers. An area we believe may merit further study is whether white strobe lighting is less likely to attract and disorient nocturnal migrants. If the use of strobe lighting is determined to be more “bird friendly,” the wireless industry would need the help and support of ornithological groups in educating zoning boards and community groups about why strobe lighting may be preferable to red beacon lighting.

In conclusion, our organization and our industry look forward to working with you on this.

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Presentation Number 15

Tower sitings, co-location - one industry's creative approach to antenna placement

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Al Manville's introduction of the fifteenth speaker, Mike Allred.

Our next speaker comes from Southwestern Bell Mobile Systems, SBC Wireless, from Dallas, Texas. He's worked with them for the past 10 years. He's held several positions in his capacity with that firm including manager for cellular tower construction, manager for facilities, and manager for EPA compliance. Mike Allred is going to be talking this afternoon about tower sitings and co-location; one industries creative approach to antenna placement. Mike.

Mike Allred

[The following text is adapted from the author's abstract for the conference. Various slides were used by the speaker.]

The presenter reviewed some creative approaches to siting and mounting cellular antennas. His discussion included some of the mandates under the National Environmental Policy Act (NEPA) that a communications or tower company must consider, as well as issues related to tower placement and co-location with other carriers. He also reviewed the NEPA checklist, which includes the following: is the facility (including the tower structure, road[s], wires, etc.) to be located in an officially designated wilderness area; is the facility located in an officially designated preserve; will the facility affect threatened or endangered species or critical habitat; will the facility be located in, on, or within an area significant to American history; will the facility affect an Indian religious site; will the facility be located in a flood plain; will the construction change surface features; will the facility be equipped with intensity lights; will power levels be within specified FCC guidelines; and will this site cause any public controversy?

Slides were also shown depicting creative ways cellular antennas can and are being mounted (*e.g.*, on monopoles, behind billboards, in church steeples, on buildings, and on water towers).

**Presentation number 15
in the workshop
Avian Mortality at Communications Towers
www.towerkill.com**

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Presentation Number 16

Research and policy overview: a critique and needs analysis

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Al Manville's introduction of the sixteenth speaker, Kathleen Rogers.

Our final speaker this afternoon – before we convene our panel discussion – is currently the Director of Land Use Policy for the Piedmont Environmental Council in Warrenton, Virginia. I've also known her in the past in a capacity as Wildlife Counsel with the National Audubon Society. She was an Associate with the law firm of Beveridge & Diamond, and worked on a number of environmental issues with them. She's been a law clerk with a United States District Court Judge in Washington, DC. She served on the United Nations Conference on Women Council, she worked on the Lake Placid Olympic Organizing Committee, and she worked for the British Broadcasting Corporation before that. Kathleen Rogers is going to give us a research and policy overview, critique and needs analysis. Kathleen.

Kathleen Rogers

This section of course is a public policy section, but I think it has a lot of implications for research. I think very quickly, we have to think about the three different types of towers we're talking about here. The first is existing radio and broadcast towers, most of which have been described as monsters, big ones. The second are the PCS cell towers. They're currently being built and there are many, many, many of them. And to go back and talk about Sheldon – and it's not Sheldon's fault – but one of the comments he made about wireless service providers not knowing about the bird implications. I think it's probably incumbent on the industry – and they could probably do it in a few days through their website and other places – to let their providers know that there is this issue. The third, of course, is digital TV towers which are the big, big, big ones that are coming down the pike and those towers are the ones, I think, that will be particularly the issue for both the research and the public policy concerns.

Let me just tell you that the Telecommunications Act [1996] does prohibit, it prohibits localities from prohibiting service completely and it prohibits them from discriminating against providers, but that's about all it prohibits. What it does allow localities – meaning local governments in all of your counties, you each live in a county and each of those counties will have tower applications before them, they have them now, they've had them in the past, they'll have them in the future – it allows those counties to prohibit, for example the building of the cheapest tower. Providers are not allowed or given permission under the law to build the absolute cheapest tower. That provider may have to build multiple towers below a tree-line and that is permissible under the Telecommunications Act. In which case it would eliminate, in most, except for the rarest of circumstances, at least PCS towers over 200 feet. So all of a sudden we're looking at a smaller group of towers if we really do follow what localities have been able to do in many jurisdictions.

Except again, in the rarest of circumstances, you're not going to see PCS towers over 200 feet if localities have anything to do with it.

The next is that it allows counties to prohibit builders from building anywhere they want. It allows them to require builders to find very unobtrusive places like Mike Allred of Southwestern Bell just talked about and they've been terrific in terms of avoiding a lot of problem situations in many counties in which they work. There is an exception to this which I think is an issue and I think it was raised by one of the speakers today which is that in state department of transportation right-of-ways. State departments of transportation are allowed, are allowing, and have permission to allow cell towers to be built in the right-of-ways and those towers that they build escape local jurisdiction. Fairfax County challenged that because Virginia is notoriously bad at environmental protection and they have allowed, I think over 100 towers to be built – many in the right-of-ways and they are a problem. That's been challenged; they lost at the local level, but they're appealing it so that's something to watch and it was raised by someone here as towers built in right-of-ways because there is no local power to do much about it or so it's been said.

I think case law, just so everyone knows, has been pretty supportive of everything I've said. Occasionally a locality will lose. They may not have the money to appeal, but generally speaking a lot of the case law supports the fact that counties can basically tell cell tower providers where they want them to ride and require them to co-locate and things like that. So I guess my view is, except in the rarest of circumstances, we shouldn't have to be dealing with towers over 200 feet if we're talking about cell towers. I work in an area of the country that is about the size of New Jersey with 12 counties and in our counties we have sometimes at any given time 12 to 15 applications for sites in each county. It's a lot of towers to fight, it's a lot of towers to deal with, but there is one of the things that you can all do. Those applications are generally on the web and if people can focus, you can send comments in either through the web to the county and let them know you either don't like the placement of the tower, or it's along a migratory bird route and they will be able to consider that as part of their environmental review. I can talk about that a little bit more at the end.

So I think the question is what really is FCC's role in this, what is the local county's role, and what is our role, both with respect to research and with respect to what I'll call "activism" for lack of a better word. I don't want to hit Holly when she's down – she's a darling, but she's sitting back there with a sprained ankle – but since she's down, I'll go ahead. I think the FCC's interpretation of NEPA is simply awful and incorrect as a matter of law. The Council for Environmental Quality (CEQ) – the mother of NEPA regulations – allows you to consider things beyond what the FCC is considering in their list of 8 things that were put up on the screen [Mike Allred's presentation]. They've always provided for looking at general environmental harm and I think that if it is pursued to the detriment of migratory birds then it is ripe for challenge. I think also it is important to look at both CEQ and EPA's recent guidance on NEPA. I'll just quickly read to you, EPA's for example says, "An EPA reviewer can identify geographic area and extend the area when necessary to include the same or other resources affected by the impacts of the project." In other words, EPA and CEQ are taking an ecosystem view of a proposed project so in this case, in the case of a cell tower, I think it's perfectly reasonable to include cumulative impacts along the migratory route. It could be very, very long, but as long as we have the evidence and the impact, particularly if it's a migratory stop-over, etc., I think all of that is something that the FCC can take into account. In fact, because they have taken it into account, and it has been raised with them, I think it's incumbent on them to do that in every circumstance when you have any evidence at all and certainly they know it's an issue.

I think the other thing is that CEQ's regulations also allow you to take into consideration, when you are doing this analysis – in fact they require it where it is reasonably foreseeable – that it is indeed reasonably foreseeable that there will be thousands of towers built. Therefore, cumulative impacts analysis under NEPA requires us to take into consideration that thousands of towers are reasonably foreseeable to be built and therefore we should consider them in toto. Even if they're not yet built.

And I think everyone would agree, if you looked at the law on this, that it's pretty clear that you can take the future construction of these towers into account when you're analyzing it.

That's exactly what we all want to be able to consider. Sit down, put the towers on a map and look at where they are going to be. Industry knows where they are building. They've been in my office many times, for example SPRINT and other people 6 to 8 months ago and said, "within four years, we want x number of towers." And they'll show you a county map and where the towers are going to be placed. That's just one provider in the county. There are multiple providers in every county. You can do what's called an "all-call." Again, Fairfax County did it, where all the cell tower providers are required to put their plans down on paper so that the county can force them to be where they want them to be. That's something that is perfectly viable and acceptable under the FCC rules.

Just quickly, what can you do? I think there is a great need to work with other groups on this and possibly a subcommittee of us could focus on this. I'll give you an example, the Appalachian Trail Conference, a great group that manages a couple thousand miles of the Appalachian Trail. They're about to announce an agreement with the industry which they've negotiated hard and long on, that they're very proud of, that gives them the right to be consulted with any towers placed in front of a scenic trail. Scenic America is doing the same thing. That's great, but that doesn't really help us and the same thing is true of a lot of other groups. They're negotiating agreements with the industry, but we should all be working together.

We should lobby as quickly as we can and as hard as we can, both the Administration and Congress, for money for Holly to do two things. One is for her agency [FCC] to conduct the research or to require that research be done by the industry. And that's not unheard of – it happens in a lot of other contexts. And secondly, let's lobby for Holly for money for other employees to help her. She doesn't have a single environmental reviewer among her staff and that responsibility is not hers, but the FCC has "passed to the fox the hen house review," and so you have the providers doing the environmental research and then you have nobody at the FCC that's competent to review it. This seems to me to be close to insane, but anyway. And I think the FCC would appreciate it. They're a small agency, as Holly said, and they don't have a lot of money, so I think it is something we can help them with.

I think the FCC could quickly create a scientific advisory board. They can do that right now under regular agency law. We should sit on it, we should review permits, all that sort of thing, that we should be able to go ahead and do in working with industry – put the committee together. As I said most of the action is at the county level, you can work with the birding groups, the Sierra Club, National Audubon has chapters all over the place, get on the web. Let the [Audubon] Chapters and all these places pay attention to what's coming up in their counties. Every tower will have county review, even if it's in a right-of-way. Those counties can get information to you. Most counties are on the web so you can respond and say, "yes, that's a problem"; "yes, it's a migratory bird corridor"; and, "yes, it's an important bird area", whatever it is, you can get it very easily if we just get organized.

Work with industry, a lot of them are really great and they're trying to help out. I just spoke to a person who has invested a lot of time in camouflaging towers and putting them in out-of-the-way places. There are people in the industry that we can work with.

Let's petition for a rule-making to help the FCC out if they say they can't do more. Let's do it.

I don't want to pick on Sheldon, but there's another thing he said which is, "it's not been conclusively demonstrated that there's a problem and no administrative or policy measure for limiting fatal interactions should be considered until conclusive evidence is provided." That's not as matter of law. In the legal standard, you don't have to have conclusive evidence before you take action. I'd recommend a petition on the rule making and I think Fish and Wildlife Service – based on their presentation – would probably agree. Find the right site to challenge. If we had a site that's particularly bad, where we know there are a lot of bird kills, let's challenge the continued operation of the site. I think that is perfectly acceptable.

Modification of towers and re-licensing of towers give people the opportunity to step in. If modification or re-licensing are carried out, you have an opportunity to request, in certain circumstances, modification of what the tower looks like.

And finally, I look at a lot of model contracts that landowners sign. Often, particularly in rural areas – that is where a lot of these things are going to be – you have landowners who need money.

They'll sign these contracts if it looks lucrative to them and at the end of the contract it says, "all improvements on your property belong to you." Well, not a lot of them think that means the tower, but it does. And so when the service is no longer needed, and it will become obsolete fairly quickly – you know, 5, 10, 15 years it will become obsolete – the landowner is then stuck with taking the tower down. A lot of counties are now requiring bonding so that there is money available to take them down. So I think that's also really something we could petition either Congress or the FCC to require because I think it's all within their power. Thank you very much.

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Summary Panel Discussion

Al Manville's Introduction of New Panel Members:

Dr. Michael Avery. He participated in the RESOLVE discussions last June, he did an M.Sc. at North Dakota State, and a Ph.D. in Wildlife Ecology at the University of California, Davis. Michael is currently Project Leader of the USDA National Wildlife Research Center, Gainesville, Florida. He previously has worked for the U.S. Fish & Wildlife Service and the National Park Service. He is active with the *Journal of Wildlife Management* and with other issues.

Arthur Clark. He participated in the RESOLVE discussions on June 29th and is the Associate Curator of Vertebrate Zoology at the Buffalo Museum of Science, Buffalo, New York. Art has studied bird kills at television towers in western New York State since 1967. Over a 32-year period, he has retrieved 20,330 tower-killed birds of a 110 different species.

John Powers. He is Vice President of Regional Markets for Crown Castle International, Albany, NY. Crown Castle owns the largest number of towers in the world. They own all of BBC's towers and Bell Atlantic's towers. He is responsible for the development and operation of all Crown Castle regional offices in the United States, which is currently in an excess of 14,000 towers at 15 offices. For 14 years he previously worked for the Motorola Corporation.

Dave Wilson. He is with the Office of Science and Technology Department, of the National Association of Broadcasters, in Washington, DC.

Gerald Winegrad. He is Vice President for Policy for the American Bird Conservancy, Washington, DC. Gerald served as a State Senator from the State of Maryland for approximately 16 years where he worked on a number of legislative issues dealing with the environment.

Steve Ugoretz. He is with the Wisconsin Department of Natural Resources, in Madison. Steve is an Environmental Analyst and Review Specialist. He chairs the Wisconsin Department's Energy Team and is also on the Avian Subcommittee of the National Wind Coordinating Committee – an issue with which my agency is also involved dealing with the wind industry that I sighted earlier this afternoon.

Ladies and gentlemen, welcome to you all. Let us begin the panel discussion.

Discussion

Al Manville – We have 6 or 7 questions that Gerald [Winegrad] and Kathleen [Rogers] have retrieved from the audience. Let's do this first. Let's take a stab at answering these questions, then we will get into the nitty-gritty of a discussion on what needs to be done regarding research. Gerald is going to read the question; it's directed either to a specific speaker or generically to the panel.

Gerald Winegrad – The first question is to Ron Larkin. The question, “could one measure other physical signs of exhaustion like lactic acid content to test the hypothesis of birds tiring of circling and dropping to the ground?”

Ron Larkin – Yes. If you have a dead bird, you can do practically anything you want with the carcass at that point. There are no regulations covering you. You are picking up an animal that would otherwise be scavenged and completely lost to science so DNA analyses would be quite fruitful. Analysis of the fat content would be quite fruitful. And many, many different physiological measures including for instance corticosterone would be very, very interesting to look at in these birds. Absolutely.

Gerald Winegrad – OK, Holly Berland has been very popular. I don’t know if it’s because of her ankle sprain or the FCC. I am going to try and combine these so that everyone gets their questions answered by Holly. “How does the public interest response to the FCC licensers affect their responsibility to actively address the bird, tower-kill issue and also, given the need for research into the issue of birds killed by towers, would the FCC consider changing its rules to require licensees to pay for research?”

Holly Berland – I’m glad that you asked that question. The topic of migratory birds and the potential impact of towers is a relatively new area and new subject for the Agency staff. We are getting involved by attending meetings such as this. The Commission has neither categorically excluded nor addressed migratory birds on a routine basis. In other words, the Commission has not decided that individually or cumulatively towers will not affect migratory birds. Simply, the Commission has not addressed it. The Commission’s environmental rules are silent in so far as migratory birds. Unfortunately, as a regulatory Agency, given the lack of scientific information and studies at this juncture, it might be considered irresponsible for the Agency at this point in time to routinely require our licensees to take into account migratory birds. We are interested, of course, in further studies and would participate on panels and try to do what we can, but at this juncture it’s not necessarily accurate to say the Commission has just simply avoided it. We just do not know. Just like the FAA, this is a new subject and we’re in a get-information- gathering/learning mode at this juncture. Is that clear, a little clearer? I mean we have not made a determination. We’ve only looked at it on occasion.

Gerald Winegrad – Holly, the follow-up to one other question that was specific is that the questioner states that, “there has been a request by the National Audubon Society in a filing that the FCC do an Environmental Impact Study under NEPA of the whole issue. Where is that?”

Holly Berland – I believe that the Audubon Society’s petition dealt with DTV preemption – public notice. The public notice was issued because it was thought at the time that with the rapid deployment of DTV that the broadcasters would experience zoning and siting problems. But in point-of-fact, that has not been the case because the Agency at this juncture is not going forward with the order. That public notice was subsumed in the Notice of Proposed Rule Making to preempt local zoning in so far as DTV, and at this point, we’re not going forward. I guess it’s on hold.

Gerald Winegrad – For Dave Bayley of the FAA. “Isn’t there an aviation safety interest in avoiding groups of birds, hovering around towers on reduced visibility conditions?”

Dave Bayley – Yes, there’s always an aviation safety interest in avoiding birds, but there is also a safety aviation interest in avoiding the tower itself. We wouldn’t like to see either birds or aircraft in close proximity to the tower. Where the tower becomes an attraction to large numbers of birds, that could become a problem to aviation safety if it is close to an airport or a flyway that we use routinely. I don’t know if that answers it or not.

Gerald Winegrad – This one isn't directed to anyone in particular, but it reads, "please provide suggestions on how to estimate losses of tower-kill birds to predators and scavengers." Is there any science-based way to do that? There were several people that spoke on that issue. Paul Kerlinger?

Paul Kerlinger – Yes, those types of studies are fairly standard. What you do is you simply put out carcasses in an area and you go back and check them on a regular basis. You do that a few times until you get a rate of removal and then you incorporate that rate of removal into your overall model for determining the actual number of birds that were out there originally.

Ron Larkin – This might be a little more difficult in the case of nocturnal bird kills. First of all, the scavengers become good at checking the towers. There is a strong component of the animal's learning and the animal's altering its home range under certain environmental circumstances. We don't for instance know whether there is more scavenging after a cloudy night, or in certain atmospheric pressure conditions than in others with towers, but it wouldn't be hard to investigate. You cut the grass like a golf course as was suggested earlier, you put up a chain-link fence around the tower, you check the birds inside the chain-link fence and outside the chain-link fence – an enclosure experiment. You put radio-monitoring on local carnivores to see whether they check the tower under certain environmental situations. You can test the various problems and hypotheses I just brought up – these are pretty standard techniques.

Sid Gauthreaux – Just a quick comment. The owl feather you saw in one of the photographs of the collision victims was not an accident. It wasn't a victim. In our study in Charleston, [SC], we had to race Great Horned Owls to pick up birds as you could hear the sound of the bird hitting the ground and so did the owls, and the owls would vector in on the birds just as we would. So putting out birds and not going through the actual event of having the birds hit the ground and having the predator notice it at the same time the researchers noted – you may severely underestimate predator removal.

Gerald Winegrad – OK, the next question is for the wireless industry. I guess this is directed to Sheldon Moss. "Given that there is still much to be done to demonstrate conclusively that communications towers have a detrimental effect on bird populations, wouldn't it be wise to apply the precautionary principle when the chance that the risk of losing some of these declining populations is too great to adopt simply a wait-and-see attitude?"

Sheldon Moss – [steers question to John Powers of Crown Castle International].

John Powers – In terms of preventative measures, the whole reason our company exists is because the FCC has recommended preventative measures, in terms of reducing the number of towers in general. So, the industry that I'm in is tower co-location, and it exists for that exact reason. I've repeatedly heard today that there are thousands of towers being built. Right now we average about 9 tenants on our original towers in Pittsburgh. Some towers you have as many as 120 tenants, and that's pretty much any wireless carrier with an antenna – where before you would have had 6 different people going out there and building towers, you heard Southwestern Bell, you heard Sheldon, you heard other people talking about co-location. They are trying to reduce the number of towers. It's a situation where on both sides there is an education process going on. There is an education process understanding what is being deployed in wireless – what technology. Because from the studies I've seen on tower kills, the majority and the worst offenders have been the tall towers, which are typically broadcast towers. Those are very high power, very tall towers and they are usually guyed towers. When you look at the majority of towers that are going through zoning, and getting processed to be built, it's all low-power broadcast transmission, like personal communications which is typically under 200 feet. So regarding preventative measures, I think the FCC is making recommendations.

They have not got to the point where they can demand things because there's other rights that they infringe on, but they have made very strong recommendations across the industry on co-locating and everything else – not only worried about the migratory bird problem, but the total proliferation of towers, because I think there is recognition but you are getting education on both sides and that's why companies like myself are here today to make sure that we continue our education in terms of the issues with not only migratory birds but wildlife in general.

Sheldon Moss – One other general concern from the industry, and I think it has been pretty evident from the discussion today, I think that we are all struggling to get an overall assessment of the scope of the problem. I know this sounds a little self-serving, but from an industry standpoint, we'd have some serious doubts about being engaged in something like a large-scale mitigation program that was very costly and could essentially jeopardize the ability of the industry to be able to advance this telecommunications revolution. If it turned out that the overall cumulative effect of these towers was relatively minor and there potentially could be other reasons why certain populations of protected species are actually declining, the industry would be a little-bit concerned if it was required to take some truly heroic measures that in the final result didn't really achieve anything while other more important or more meaningful sources of bird fatalities essentially go unchecked. So before advancing we think that more needs to be done.

Dave Wilson – If I could just add something with regard to the broadcasters prospective on this, I've heard a number of people today particularly Kathleen [Rogers] in her talk kind of categorize the types of towers as PCS/cellular and these monster-like broadcast towers, and Kathleen also broke it down into 3 categories where existing radio and TV were in one category and then she implied that digital television towers would be even bigger. I don't think that's really quite an accurate breakdown of the way or the size of towers. Really what it boils down to is the two-way, high-volume mobile communications like cellular and PCS, each tower, generally speaking, especially in urban areas or heavily populated areas, has a lower height because it has a smaller coverage area because they need more small coverage areas in order to increase the capacity of the entire system and serve as many cellular and PCS telephone customers as they can in one time.

On the other hand, in transmission systems where you have a single tower that is feeding a one-way communication to a large population in that case, in order to efficiently serve a wide area without having multiple towers – in keeping the number of towers to a minimum – you have to have a much taller tower. And that applies to broadcasting which is obviously a one-way transmission, but it also applies to – and Sheldon alluded to this in his comments which I thought were very good – it also applies to things like police, fire, ambulance and all those sort of land/mobile communications. I happen to be on the board of directors of a radio station in Virginia that is leasing space from Motorola on a Motorola tower that is over 200 feet tall which has the local police department, local ambulance, fire, etc. are all up there and they have the highest positions on the tower because they are very concerned about a wide coverage area. So really when you're thinking about the tall, large towers, you have to also think about all those important public safety things that are going on because they really need to be just as tall, as high up as broadcast towers. And also just to add, there is no real difference between the height of a digital TV antenna and the height of an analog TV antenna, they are really essentially the same thing. Most analog TV broadcasters are trying to get their digital antenna on their same tower because the tower is so expensive to build.

Gerald Winegrad – Thank you very much. The next question is for the gentlemen from Southwestern Bell Wireless SBC, Mike Allred. “Is it true that the Washington Monument is really a stealth cell-phone tower?” I'm sorry, you don't have to answer that. [laughter] The next question is a profound one and that is, “do we have scientific evidence or knowledge to make recommendations for new towers on how to reduce avian mortality?”

Al Manville – Which leads us into our discussion this afternoon.

Gerald Winegrad – Do you want to skip that one for further discussion?

Al Manville – We're running out of time here, so let's start the discussion. Do you want to read the question again, Gerald?

Gerald Winegrad – “Do we have scientific evidence or knowledge to make recommendations for new towers on how to reduce avian mortality?”

Mike Avery – I'd like to take a stab at starting the discussion. There aren't a whole lot of options available for some of these towers once you site them, once they're at a location and are going to be built. The two things that would help, in my opinion, to reduce mortality at any new structure would be to do it without guy wires if that is possible, and to do it with the lights that are on the least amount of time possible, in this case the strobe lights. Strobe lighting would, I think, create an environment at the tower during nocturnal migration that would be less harmful to the birds than a continuously lighted situation that we see with the red, blinking obstruction lights. Other than that, I don't think that we have any information that I know of that would bear on that question. That's why we need research on it.

Al Manville – Let me ask a question of Dave Bayley. This gets into the lighting issue and Michael, you may have proposed this in something you sent me and we discussed a little bit at the RESOLVE meeting [June 29, 1999]. What kind of flexibility and leeway does the FAA and Holly need (to address this to the FCC as well) to allow us to continue to maintain the towers in a safe manner as far as lighting is concerned but expand the duration – put, say, a light that has a dark phase of maybe 4 to 6 seconds as opposed to 1 to 2 or just blinking or solid red as some of them do? What kind of flexibility do you suppose the FAA has there as far as allowing or at least assessing that from a pilot-safety standpoint?

Dave Bayley – Well, I don't know that they've done any assessment recently on it, I mean the rules have been around for a number of years and they're the ones that we've kind of used as tried and true. As far as the flexibility on it, it pretty much depends. Any lighting we do is usually, as I said, in response to what the proponent wants us to do. I offered the suggestion that there may be some proponent who would be willing to experiment by using different types of lighting such as maybe a different flash sequence or some other sequence with the red, but I'm not so sure that we could enforce that as far as that goes. Anything you do, it kind of goes back to the original question of what can be done to mitigate the avian mortality. I think you have to look at it as connected to how do we, as humans, perceive those lights. What makes them conspicuous to a pilot if it's making it conspicuous to the birds also and creating a problem, then is there an alternative, and that's something that would have to be researched. Presently, in the scheme of things that we have, I would say there probably isn't much flexibility other than if there is something out there where you could configure the lights and approach it from a standpoint of an experiment. If it's not in a major [aircraft] flyway, possibly set up a Notice to Airmen so that they would be aware of this. We do all sorts of research with lasers where we notify the airman about the lasers and we set it up for these research lasers such as UNH [University of New Hampshire] and MIT [Massachusetts Institute of Technology] are doing where they have spotters, they use radar to detect aircraft that may be approaching, and in a scenario like that, you might be able to set up a lighting experiment. That's about the best I could hope for at this point, but it's not something that we've really even looked at. It probably requires some sort of research. I would offer that as a possibility.

Al Manville – One of the things that we discussed at the RESOLVE meeting was tying in with NOAA's weather database and through computer analysis determine when the most likely bad-weather events would be.

Then tie in these with the migrations – spring and fall – and then try to key in the studies based on when we expect we’re going to see low-ceiling obscuration, cloudy , misty conditions on X number of days. Then, say, over the past whatever number of years, we found them to be the month of say March – or whatever – at this particular location. That way you could focus in on when the likely events would occur and then do what you’re suggesting.

Dave Bayley– Yes, I think if you satisfy the needs of both communities. As I said, this is new to the FAA as far as this being an environmental problem and it’s not that we’re trying to turn our backs toward it, but our mandate is to provide for safety to aviation and to the extent that we can incorporate some sort of mitigation for this particular problem, I don’t see that that’s a major problem as far as looking at the issue, but you’re going to have to identify what the problem is and what the solutions are. As I said, then we can look at how it will affect making the towers visible to aircraft. So to the extent that we can satisfy our mandate to maintain a safe system then we would incorporate those environmental concerns. Show us the research.

Al Manville– Steve [Ugoretz].

Steve Ugoretz – I know that most if not all airplanes are able to activate some of the smaller landing strips that don’t have operators there to turn on the lights. Most of them are able to with use of their radio on a certain frequency activate landing lights. Is there some way that the system which is pre-existing – therefore would not require, one assumes, a lot of investment – could be used to turn on and off the towers? I know the towers are marked on the aviation charts and could they squawk on the tower lights the same way they squawk on the automatic landing lights?

Dave Bayley – Well again, it’s part of the technology that is out there, but to do some of these things – and it was mentioned in the rule-making as a possibility that’s something you have to do – yes, if you want to turn the lights on, could you do it remotely? I’m sure you could. Would it satisfy the needs for safe aviation? That’s something we would have to look at, the technology there, and then everybody has to comment on that, because anything we do as a Federal action then, everybody has to weigh in on that. We put it in the *Federal Register*, they all come back with their comments and again it will get down to cost. Is it cost neutral so that pilots wouldn’t object? Is it still going to provide for safety? If the pilot forgets to look at the chart or doesn’t hit some sort of device that would turn the lights on, and then he hits the tower – who’s going to be responsible in that case?

Al Manville – Ron [Larkin], you had a question.

Ron Larkin – I would like to make two simple comments. I’m not an air safety expert, just a person who has thought about this and read about it some. One is that we have a policy question here which is what could we do to towers that might still keep them safe for people and make them safe for birds. Nobody in this room can answer that question right now because we don’t know what the nature of those changes to the lights should be. Therefore, what we really are talking about is the purpose of Al’s panel discussion right now, which is, what research do we need to do to establish that question? I’ll simply state that it is easy to design a very, very – let’s say – totally safe experiment using 1 tower or 2 towers that are not ever going to affect the air safety around the area, but can provide us excellent data to answer that first issue. You don’t need to do it over the whole country, you just need a couple of towers in a certain place, maybe an airport radar nearby that tells you where all planes are all the time. This is not a difficult problem.

The second issue I wanted to bring up is that turning off the lights might only be a short-term solution over the slightly longer-term. I’m going to make the radical statement that tower lights are obsolete and airport radars are obsolete.

Aircraft within the next 4 or 5 years are going to be turning almost exclusively to using GPS to navigate by in three dimensions and landing aircraft will be [GPS driven] – and the pilot will almost be redundant except in the very last stages of landing. GPS is going to rule the aviation industry and what that means is a pilot looking out through the wind screen [canopy] is [relying on] a secondary safety device [the lights] in the aircraft. It's that way with big commercial aircraft, pretty much right now, and it's going to be that way in general aviation aircraft because we're going to have something the size of a toaster that will tell the plane exactly where it is in space to within a few meters and will know where all the towers in North America are in its database. That's technologically easily [available] as of about last year, so many of these questions of what can we do in terms of lights and towers might become obsolete in a few years. Wouldn't that be nice.

Al Manville – Bill, you had a comment.

Bill Evans – I was wondering if Dave [Bayley] knew how many collisions with towers there have been with planes, say over the last decade? I mean, what's the frequency?

Dave Bayley – I don't think there has been any empirical data. Someone, when we had a tower proposed in Rhode Island that was going to be nearly 1,000 feet high, alluded to a case 30 years ago and sent me a newspaper clipping of a small aircraft that had hit that tower, but I can't say in my 20 years in the FAA that I have any knowledge directly. I'm sure that there's the possibility that that has happened.

It's ironic that you mentioned that because often times when we get people who resist our requests to mark and light a tower they'll say but we've been here for 30 years and nobody has hit us yet, and because of re-registration we've gone to the FAA. Our determination will be that they mark and light it. We try to provide a zero accident rate.

Sheldon Moss – I mean just in the last year – Holly you might know more about this – the FCC publicized at least 2 near misses where helicopters came close to communication towers and I know that there wasn't actually a collision but it certainly raised a lot of concern at the FCC and they did impose some pretty hefty fines – what they call forfeitures – on the owners of the towers.

Al Manville – I have a question that I would like to address to John Powers and/or Dave Wilson. We discussed this a little-bit at the RESOLVE meeting and it's been bouncing around, this is the issue of, "will satellites replace many if not most of the existing technologies within the next 20 to 25 years?" Holly responded at the RESOLVE meeting that in some cases, simply not. Can you shed any additional light on that?

John Powers – I'll just take one example to try to give you a perspective on that. The most complex, most sophisticated satellite constellation today is Motorola's Iridium. It basically consists of 72 mid-earth orbiting satellites that provide voice communication. It's not data communication, it's not television broadcast, it's voice and it's 72 satellites. The effort to launch it was highly publicized with somewhere between an \$8 to 9 billion launch. The capacity of that system is roughly about the capacity of your wireless system in New York City. So to put it in perspective, the belief that satellites will replace the towers is definitely not the case. And there continues to be more roll-out of more wireless services everything from wireless cable, personal communications, and you'll continue to see digital roll-out. Actually from a lot of peoples' perspectives, digital television should be good news because what it does is by digitizing your signal. You're taking and compressing what used to take a lot more bandwidth onto less bandwidth. So now a television broadcaster can provide much more with less space which eventually will provide less requirements at tower sites, and more economics for having gone on lower facilities at some point in time if it's economically feasible.

But it's not, and Dave [Bayley] made this point that is very important. The wireless industry converted to digital, they didn't put up more towers.

What they do is that they allocate a portion of the spectrum and now compress a number of signals onto a single channel where before they occupied multiple channels. The towers are not going to be reduced by satellites in the near future. I think that's a pretty safe conclusion.

Dave Wilson – I think that those remarks are right on point and I won't really add too much to them except – somebody eluded earlier in the presentation portion about the strong desire in the government – and I think most people would agree, most Americans would agree – that competition is very important to our telecommunications service market place. There is only a limited number of satellite slots and to have everything focused or provided by satellite, while it wouldn't necessarily be all from the same company, you are really limiting the amount of competition you can have in telecommunications if you're going to say, well there is going to be no terrestrial communication, only satellite – that's a very important economic component.

Al Manville – OK, let's jump into the research issue here. We've heard a number of suggestions dealing with lighting issues this afternoon and on previous occasions. Can we agree that we need to focus on the question of, "is it the color of the light, the frequency of the light, or is it the issue of duration between the pulse that makes a difference? What's attracting the birds?" Does that seem to be the issue? I know a number of you have talked about that today, so let me just throw that out as a question for discussion.

Michael Avery – I would like to suggest that before we start talking about technical details like that, which are important, I think that we ought to go back to defining the problem which is what I keep hearing from the industry representatives and from the Federal agencies here is that we really don't have a good handle on the problem. Until we do, it's going to be awfully hard to convince, I think, to push for any changes. Any investigation you begin, you begin with defining the problem, the extent, the nature, etc. I really think that's where the research needs to be focused initially. The lights are important, but again, what if you find out something, you still have to show these guys that there's a problem out there.

Al Manville – Michael, how would you suggest going about that? I know you had sent me some notes on that.

Michael Avery – Well, there's been a number of suggestions to try to standardize a methodology with the advice of statistical experts to sample if you will use the existing structures and come up with a – I would say at least a 3 to 5 year period of time where we actually quantify what's being killed. I'll leave the statistics to someone else. It would take a real concerted effort to do it properly, but until we do, I don't really see much progress being made. This has been going on for 50 years, the first bird kill that I know of at a tower took place in 1948 in Baltimore and it's still happening, so we're no farther along than when this was first being recorded. So I really think that it's going to have to take an agency like the Fish and Wildlife Service, for example, to run this thing and to get a group of interested parties together and try to start figuring out what we're dealing with out here.

Steven Ugoretz – Yes, I agree that determining the magnitude of the problem is important. I think to do that you not only have to incorporate a standardized methodology and metrics, but also some of the characteristics of the towers [especially] if you want to try to get estimates of overall numbers of birds killed. If it has anything to do with the lighting or the height which may be more important or just as important as the lighting, those have to be incorporated into any of the studies that you do. Also, you might not want to lose time by not ignoring some of those questions early on and start examining them very carefully right from the get-go, right from the beginning. So by incorporating all of those, you get a much better picture, you might even get a better bang for your buck as well.

Gerald Winegrad – I think both the literature as well as individual tower data, if you will, documents well that there are literally hundreds of thousands, millions probably, of migratory birds killed each year. If someone was doing the same thing by shot-gunning them collectively around the country there would be a public cry and we wouldn't even be sitting at this table. The FWS would be enforcing the law, the FAA would be writing and requiring EA's on bird impacts, and the industry would have already funded and found the solutions to the problems. I think that while you can always do more research probably for the next 100 years and document the extent at individual towers and look at the different types of towers, weather events, non-weather events, and count the different warblers and those many species of songbirds which the evidence clearly documents are the main birds killed – with so many of those species in decline because of various reasons – I don't think that we can sit here and say that something that may be rather simple, such as changing the color of the lights or pulsing the lights, should not be examined in research. That research should be done right now. We all ought to work collectively, like what was done in the power transmission industry to find the spaces and the collective solution with the Electric Power Research Institute, NGO's, and the government. I think that's what we ought to be working on is solutions to keep the birds from being killed. I mean we have documentation after documentation – Kansas tower events – some of them over 30 and 40 years, where birds are being killed.

Al Manville – That's a good point. One of the points that I made earlier is that we need to do the same thing that we've done through the Avian Power Line Interaction Committee, and through the National Wind Coordinating Committee's Avian Subcommittee there, to try to deal with those problems, and use that as a model. I would extend an invitation to the communications industry to join us in that very effort. Folks here at the table would be a great start at getting that initiative formed because that's what its going to take, I think. Steve [Ugoretz], you had a comment?

Steve Ugoretz – Yes, I think one of the things that we might want to consider is if it is a matter of defining the geographical scope of tower mortality of even the technological scope – in other words the types of towers and height classification of towers – maybe we need to look at a kind of triage approach here of seeing if we can mount some kind of rapid response effort to get some very basic information on the distribution of mortalities in different parts of the country. For instance, we heard that there appears to be much less mortality found west of the Rockies than east of the Rockies. I don't know if that's been on the basis of less people looking there and the towers being in more isolated places compared to some of the locations here in the eastern part of the country where perhaps there are more densely populated areas where there are people who have been out there looking – doing these kind of long-term voluntary monitoring at particular towers that we've been hearing about. So whatever those factors are, maybe what we need to do is put together a kind of a network of people sort of like the network that Bill has and there is going to be, which partly will also be up to the industry. Their part of it could be as simple as opening up their tower facilities to people who have been trained to do this basic monitoring. One of the problems that we had in Wisconsin where we were looking at an area where there were wind turbines proposed and where there were 3 large broadcast communications towers right adjacent to the site that we wanted to do a pre-monitoring study – base level mortality due to these facilities – only one of them allowed the researchers onto their property. Obviously there's concern if you are finding dead birds that are going to cause you a problem in terms of potential enforcement actions. If there is some way that can be addressed either by some kind of agreement between the FWS and the industry – or kind of a due-diligence type of thing where efforts to address the issue will be taken into consideration in terms of the possibility of enforcement action – that might go a long way towards opening up some of the sights we need to look at.

Al Manville – Let me get back to Michael's [Avery] suggestion about defining the problem. Let me just say that as a graduate student, one of the things I was taught – one of the first things you do in a research project is a literature review to see what's been done so you're not duplicating effort. Do we need to do a comprehensive literature search and synthesis of this issue?

Do we have enough combined information among all of you here at this table today that we could answer some of the questions that we're raising now? Or do we need to do a global search to see what else has been done, perhaps over in Europe or elsewhere?

Bill Evans – The way that this problem has come up, it was something that just sort of happened incidentally; it started in the late [19]40s and 50s, and we've been sort of living with it up until the past few years. All the sudden this change in climate with declining songbird populations and increasing towers has catalyzed concern over the issue, so I don't think we are going to find a lot of unknown studies out there. And, I actually agree with Michael [Avery] and Steve [Ugoretz] that we do need to continue doing studies on a continent-wide basis on what the size of this mortality is and possibly we could use some new technologies to help us so that we're not reduplicating these long 30-year studies before we make a conclusion.

Possibly, for example, we could have acoustic sensors on towers with a modem that was provided by the wireless companies that would radio this information to a central command post in the FWS that would basically tell when birds were flying around and calling around a tower. I mean there's a lot of different creative approaches here, but I guess when I look back at the literature, I think we've got plenty of evidence, and I stand with Gerald [Winegrad] on this. Any time you have a 1000-ft. tower and you have a kill of 1,000 birds or more, that's a problem. It's not necessarily something we need to stop our communications practices for – I mean TV and cell phones are incredible – but I think it is something that we need to devote research to, whenever you have a problem of that magnitude, or something that we estimate in the millions of songbirds killed every year.

Al Manville – I'm just thinking, for example – and I may mis-speak here – but I believe in Australia, they use yellow lights to keep insect populations down around airports to keep Nighthawks from flying around the towers so that they don't have aircraft/birdstrike issues. I wonder if there has been anything published elsewhere on that issue. I'm not familiar with it, or if any other countries have looked at issues, not so much publishing information about the magnitude and the speciation of birds that are being wacked at these towers, but more looking at what is causing these collisions. If there is something out there that we are not familiar with I would certainly not want to let that slip under the table. Let me jump into another issue – and that is funding. We heard several people comment this afternoon. Holly's [Berland] Agency is in dire need of funds to do a number of things.

Holly Berland – I wouldn't suggest that we are in dire need of funds. I just would say that we are a very small agency with a lot on our platter. But I wouldn't want to say that we are in dire need.

Al Manville – But you don't even have an Environmental Specialist on your staff.

Holly – We don't have an environmental staff per se. Our Enforcement Branch is in the various bureaus and has been reviewing Environmental Assessments along with other enforcement issues, but we do not have an environmental staff nor are we considered a land planning agency with that type of expertise on hand. We would look to somebody like the Fish and Wildlife Service for expertise in these matters.

Al Manville – And unfortunately, at the Fish and Wildlife Service's Migratory Bird Office, we just don't have the funds to really do much on this issue either. And Joe Meyers indicated that BRD would be more than willing to help – in fact, those were his closing comments – but with a caveat: a need for funds. So that gets to the issue of "how are we going to fund this initiative". I must say that at the RESOLVE meeting, Mike Allred and Jim Porter suggested that SBC Wireless would be very interested in looking into helping fund a start-up initiative, and I understand, John [Powers], that Crown Castle International might be interested in helping as well from discussions with Tom last week. This would be great if industry would be willing to pitch in and help here, and I just wondered what that possibility might be?

John Powers – That’s a loaded question. I think that Bill [Evans] hit the nail on the head when he talked about the real problem has got to be declining songbird populations. And it’s like any other study, what’s going is happen as soon as you ask for funding from any source, you’re going to have to quantify what the contribution is from any given area of what’s causing the decline. And as soon as you get one group of the industry saying “All right, we’ll participate”, it comes to a question of how do you participate. Participate with staff hours in terms of doing research, do you participate with funds, and is it equally dispersed across the industry?

And I think I can speak from a Crown Castle perspective, we’re definitely interested in making sure that we are not only an active part of an industry in providing a service, but we want to be in harmony with the community. The points that Kathleen [Rogers] brought up in Virginia – we’re very supportive of what they’re doing for it helps not only the people in the community, but the wildlife. And I think that every time you talk about the problem, you’ve gotta hit the exact problem and the exact problem here is the declining songbird populations. And then you’ve got to try to quantify what’s causing that decline. And if there’s a way we can participate I guarantee that we’re more than willing to participate, but I can tell you right now it’s not something we’re going to say hey, we’re going to fund this whole research.

Al Manville – No, and I’m not suggesting that, but I’m just thinking when Michael Measure did his presentation this afternoon, it was very interesting, of course in this case, that the Toronto Bank happened to have its logo painted in this photograph which was a bit of an embarrassment. But that aside, this is an issue where there’s ownership here. I think that there’s a real opportunity for ownership from the communication industry to jump into this, that’s why I’m suggesting a partnership much like we have with the electric utility and the wind generation industries. Those are both working, and they’re working well, and the mortality issues from both of those concerns are far less than they are with the communication towers.

John Powers – I think the representation of the industry people that you’ve got here today represents that there’s definitely an interest and a concern. I’m speaking across the board from the broadcast through the PCS industry. You’ve got those people here so there’s clearly a concerted effort that we want to be involved. As I said earlier on there’s a lot of education that needs to be done on both sides to make sure that we can’t make a decision in a vacuum. We’re not going to come up with a solution today, I can pretty much guarantee that. But every time you talk about even simple changes to lighting, then you’re going to get public outcry from the communities that say “we don’t like strobes”. And there’s always a different case to be involved. So what we need to do is really continue to educate both sides and work as a team and try to come up with a solution.

Al Manville – Here, here. And that was one of the intents of this workshop this afternoon – public education. It’s a good start. Alex, you had a question? [no question]

Sheldon Moss – One of the things that stuck me about how this discussion has progressed is it seems in one sense we’re almost talking on two parallel tracks and I confess to maybe having been part of starting the discussion about one track. I think there seems to be agreement that there is a need for being able to quantify some of the data, and as John [Powers] suggested, actually document some cause and effects and correlations between the number of towers and the declining populations of migratory songbirds. But I think there’s also a recognition that, to the extent that work can be done, and people here know a lot more about this than I do, but this is sort of a long-term process. Something that, and this is probably a modest first step that we would be able to offer from the standpoint of the industry, is while there’s certainly a need for science to be involved and decisions need to be made on good science if they have those kinds of implications, but Kathleen [Rogers] also mentioned another process that I was intimately involved with and that was the agreement that the industry essentially reached with the Appalachian Trail Conference and other groups that manage hiking trails that are covered under the National Scenic Trails Act.

That particular agreement stemmed from about a year of ongoing negotiation – the result was really a kind of a voluntary agreement where, both sides, essentially the trail folks and the wireless industry recognized that to develop solutions that everyone could live with, there probably had to be some give-and-take on both sides, and what I'm suggesting is maybe a modest step recognizing while on one track there is a need to pursue the science and get the data, but it seems to be useful for perhaps PCIA, and maybe if other organizations perhaps would be interested, to follow your lead, Al, and try to facilitate a dialog and maybe even on an informal basis where perhaps we could bring in some folks in the industry that really have some knowledge and some folks from like Bill [Evans] that have been leaders on this and continue discussions about, with the idea of finding practical and workable kinds of solutions and recognizing that in many cases the perfect can be the enemy of the good, and I think whatever could result from this sort of informal process could probably be something where there was give-and-take on both sides. But from our organization's standpoint, I think we'd be willing to certainly pursue those kinds of discussions and opportunities for further cooperation.

Al Manville – We appreciate that. Perhaps the forum that might work is this Communication Tower Working Group that we volunteered for at the RESOLVE meeting, and that we need to get moving on. That might be one option we can look at, but I thank you for that suggestion. We're running a little-bit late here, do we have any other suggestions, or comments from our panel members? Thoughts on what next or what we need to do?

Gerald Winegrad – One quick one, Al. I think what needs to be done, I think urgently, is to develop a research protocol from many of the folks that are here with the participation of the industry and the FAA, FCC, and FWS, and the other scientists that have been working on this issue of what are the research needs to resolve the tower-kill problem whether it's looking at the different cones in the birds eyes and their use of color. Whether it's sound, whether it's switching colors of lights, whether it is switching lights on to blink instead of just being solid color, or whatever, but I think that that needs to be outlined – I don't think that that has ever been put down on paper. I think that would be extremely important as well as a detailed costing of that, because I think when you talk to the industry people or agency people, the first thing they are going to say is who's going to pay for this and how much is it going to cost? I think this is extremely important and I think it is something that some of the scientists here could lead.

Al Manville – Good suggestion, Gerald. Well, thank you all very much. I appreciate your effort coming up here. Thank you for your feedback and comments. This concludes our panel discussion.

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in the workshop
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