The Charles A. and Anne Morrow

LINDBERGH · FOUNDATION

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November/December 2008

Dear Friends,

With the holiday season upon us, I would like to take this opportunity to thank you for your support of the Lindbergh Foundation and its efforts to – in my father's words, *"... discern nature's essential wisdom and combine it with our scientific knowledge."*

Over the past 31 years, more than 300 "ambassadors of balance" – Lindbergh Grant Recipients and Lindbergh Awardees – have brought our philosophy of balancing nature and scientific innovation to every continent in the world. Their creativity has helped save endangered species, preserve land, improve human health, provide sustainable farming practices, and improve economies. In recent years, I have been pleased to see so many aviation projects receive grant funding as well. These projects are focused on some of the most important environmental issues of our time and their success is your success.

I continue to be extremely proud of the Lindbergh Foundation and all it has accomplished. The Aviation Green Investment Program, which was launched late last year, is off to a good start. We have a few participants already and support from The Stanford Group included second-year funding for two of our previously-funded aviation grant projects. We established a partnership with Patty Wagstaff/Kenya Wildlife Service, which has a mission that ties in nicely with our own. We are excited to learn that the partnership with Lycoming Engines will be continuing again next year. The board and staff have been working very hard to increase the number of grant applications we receive, especially in the aviation category. We also launched a new partnership with The Orvis Company, featuring an aviation-themed line of clothing. A portion of the sales from this exclusive line benefits the Lindbergh Foundation, so I hope you'll consider doing some holiday shopping at Orvis.

It is my great pleasure to announce that the 2009 Lindbergh Award Celebration will be held at the EAA Eagles Hangar in Oshkosh, Wisc., on May 16, 2009. We will be honoring Mr. Lester Brown, founder and president of the Earth Policy Institute, for his lifelong leadership concerning environmental matters. Terry and Mary Kohler were also selected for the Lindbergh Award for their extraordinary work using their aircraft to bring whooping crane eggs from Canada to reintroduce the species here in the U.S. I hope you'll be able to join us for this wonderful celebration. I encourage you to sign-up for our E-Newsletter to receive timely updates and registration information for this great event.

Just as the St. Louis backers took a chance on my father's dream – betting that he would successfully cross the Atlantic non-stop in his little single-engine airplane, the Lindbergh Foundation takes a chance on individuals with bright ideas and boundless initiative to use scientific innovation to tackle important environmental issues around the world. For many of our grant recipients, Lindbergh Foundation funding provides the most important gift of all – recognition and the all-important start-up funds. This is a legacy of which my parents would be enormously proud, I am sure. I know that I certainly am.

I hope you'll join me in supporting the Lindbergh Foundation by making a tax-deductible gift to the Lindbergh Foundation. The need is great. The cause is worthy. The results are inspiring.

With the very best wishes, and many blessings for the holiday season to you and yours.

Sincerely,

Reeve Lindbergh

Reeve Lindbergh
Honorary Chairman

Inside

Letter from the President

Dear Friends,

This fall has been a whirlwind of activity. On Friday morning, September 26, I was invited to address the students of Lindbergh Elementary School in Little Falls, MN. They were celebrating the 15th birthday of "The Stewardship" fresco, a work created to honor Charles Lindbergh painted by my good friend, Charles Kapsner. Not knowing in advance what I would say to those 800 fidgeting children and patient adults to capture their attention, I eventually settled on the subject of elephants and how airplanes can be used not only to determine an accurate census, but also protect them from illegal poaching activity. It was great fun to see the expressions of awe on their faces as I discussed an upcoming trip to Africa to observe the Kenya Wildlife Service's anti-poaching aerial patrol.

Later that evening the Foundation held our annual Board of Directors meeting followed by a strategic planning session. Our board members unanimously agreed that our mission of awarding grants to researchers and scientists around the world who are attempting to balance technological advances with conservation and environmental concerns is more relevant today than when the Foundation was founded 31 years ago.

On Saturday night, the Foundation's "Spectrum of Aviation" hangar party was held at board member Greg Herrick's Golden Wings Museum in Blaine. We hope to make this an annual event, so if you missed out this year, watch for future event announcements in our E-Flyer and on our web site. You can read all about this great event on page 9.

Several board members and I attended the National Business Aviation Association's annual meeting in Florida. This was a great opportunity to meet other leaders in aviation, talk about the Foundation's mission, and share with industry executives the opportunity to participate in our Aviation Green Investment Program.

I'm pleased to report that board members, John and Martha King received two awards this fall. On October 16, they were honored by The Explorers Club at the annual Lowell Thomas Dinner. On October 25, they were inducted into the International Aerospace Hall of Fame at the San Diego Air & Space Museum. It was my pleasure to attend those ceremonies on behalf of the Lindbergh Foundation's board and staff and we wish them our hearty congratulations on their outstanding contributions to aviation.

Thinking back on all we have accomplished this year I am energized for the future. Yes, the economy is uncertain. But the Lindbergh Foundation is confident in our mission and looks forward to continuing to develop relationships within the aviation community, promoting our grants program, and securing funds to further our mission. I hope you'll join us.

Director News

Lindbergh Foundation Welcomes New Board Member

Dr. Knapp enjoys traveling, hiking, bicycling and kayaking all over the world.

Dr. Edward Knapp joined the Lindbergh Foundation board of directors in February 2008. He is President Emeritus at the Santa Fe Institute, a private, independent organization dedicated to a catalytic role in fostering studies in the sciences of complexity. He is also a Senior Fellow at the Los Alamos Scientific Laboratory. Previously, he was Director of the U.S. National Science Foundation, President of the Universities Research Association and a research scientist and science administrator at the Los Alamos National Laboratory (LANL).

While at LANL, Dr. Knapp's research led to several major innovations in particle accelerator design. He also led a group of physicists in support of an extensive program of cancer radiation therapy using the exotic beams of particles produced in the facility.

Dr. Knapp has had a continuing interest in applying basic scientific research results to industrial applications. In 1968 he worked with the Varian Associates to design a compact, low cost electron linear accelerator for hospital based cancer therapy using his LANL research. Today variations of this design dominate cancer radiation therapy equipment used worldwide.

Recently, Dr. Knapp and another colleague have been working through a small business to demonstrate a novel idea to detect buried land mines using high-energy gamma radiation.

Dr. Knapp graduated from Salem High School in Salem, OR. He has an A.B. degree from Pomona College and a Ph.D., in Physics from the University of California, Berkeley. He has honorary D Sc. degrees from Pomona College and Bucknell University, and was awarded the David Prescott Barrows award from Pomona College.

Dr. Knapp and his wife, Jean, make their home in Santa Fe, New Mexico.

Bird Song Study Flies into Lindbergh School District

Technology Bridges Learning in Science and Music

Bridges are important structures. They help us get from one place to another by providing a path to overcome obstacles. Dr. Margaret Coffman, a science education consultant from Ypsilanti, Mich., sees technology as a bridge to help students learn more about (and even enjoy) the study of science and music. For her innovative insight, Dr. Coffman received a Lindbergh Grant in 2007 sponsored by the Lindbergh School District and Community in St. Louis, Mo., for her project entitled, *"Empowering Students in Ecology, Music, and Computer Science through Active Participation in an Elementary Bird Song Curriculum."*

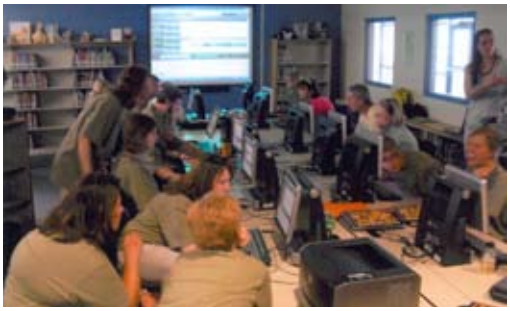
Dr. Coffman points out that elementary age students are surrounded by technology in the form of computers, cell phones, and music devices, but that does not necessarily indicate a high-level understanding of technology. Furthermore, during grades 4-6, many girls begin losing interest in science, and many boys begin losing interest in music. Studies show that animal-based themes are effective in student learning of science. With all this in mind, Dr. Coffman developed an interdisciplinary approach to improve learning by capturing the student's interest with technology and then introducing the subjects of music and science, through the study of birds. The curriculum she developed also provides an opportunity for students to realize the connection of humans to their natural environment as they develop critical thinking skills.

An added bonus to receiving the Lindbergh Grant was the collaboration she received from the Lindbergh School District in St. Louis, Mo., and the Lindbergh Eager Achievers Program (LEAP) teachers and students. This opportunity led to further development of long-distance learning technology. To bring the curriculum to the Lindbergh School District, a web site was developed and podcasts were used to provide students with access to actual bird songs and expert commentary on bird behavior and ecology, technology and music. The students were able to podcast their discussions and questions for the experts, too.

The web site includes four days of instruction materials, audio files recorded by experts in bird science and music, actual bird songs and calls, and links to related web resources. In addition, students used a special journal to record their notes and brainstorm ideas for their final project. The combination of web site materials and classroom discussion and activities enabled the students to learn and understand important concepts in science, music, and technology. Finally, the students composed an original musical composition using Mixcraft computer software and had a great time doing it.

A Day at Lindbergh School District

For the second time, the Lindbergh School District and Community sponsored a Lindbergh Foundation grant and invited the grant recipient to speak to the students. During her visit on May 8, 2008, Dr. Coffman spoke at a breakfast with fifth-grade teachers, gave a teacher workshop, and participated in a program for all district fifth-graders. "I cannot sing enough praises for Laurie Johnston and the other LEAP teachers," said Dr. Coffman. "Their enthusiasm and intelligence brought the Bird Song Project to the next level." In fact, Ms. Johnston is very interested in continuing to use the Bird Song materials and envisions designing an elective for her students to include the music of birds and other wildlife. "One of the best moments of the teacher workshop was when the teachers were sent to the computers to compose their own musical composition," said Dr. Coffman. "The teachers could now relate to the trials and success of their students."



Teachers try their hand at composing their own music.

As part of the fourth annual Lindbergh Legacy Day more than 400 fifth-graders from all the elementary schools in the Lindbergh School District circulated through several workstations to learn more about birds. For her portion of the program, Dr. Coffman and her team, Dr. Betty Anne Younker of the University of Michigan; Dr. Emily Silverman of the U.S. Fish and Wildlife Service; and Andrew McGuire and Jennifer Trombley, both music education graduates from the University of Michigan, elected to involve the students in a "voices-on" activity by singing a Dawn Chorus. To

Bird Song Project, continued on page 10

2008 Lindbergh Grant Recipient Projects

The Lindbergh Foundation selected 10 projects to receive grants this year. Lindbergh Grant projects are the cornerstone of the Foundation's mission and their global reach ensures that the Lindbergh legacy of balance resonates around the world. Each grant recipient receives up to $10,580 (the cost of building the *Spirit of St. Louis* in 1927) to support their research or education projects that use innovative ideas to foster our environment for a planet in balance.

The Foundation is deeply grateful for the financial support of the Lindbergh Grants program provided by **Knox Bridges**, North Carolina; **Cherbec Advancement Foundation**, St. Paul, Minn.; **Clare Hallward**, Canada; the **Laura Jane Musser Fund**, St. Paul, Minn.; **Reeve Lindbergh**, Vermont; **Doug and Jennifer Moreland**, Wyoming; and **Lycoming, Inc.**, Williamsport, Penn.

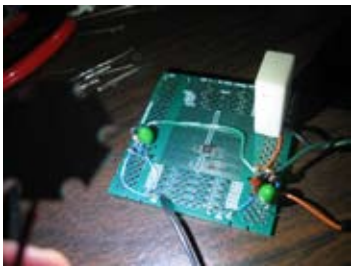
Lindbergh grants are also funded by the **Lindbergh Grant Endowment** and the **James and Maureen Lloyd Grant Endowment**.

John Barrie
The Appropriate Technology Collaborative, Ann Arbor, MI

"Creating and Disseminating an Efficient, Cost Effective Universal LED Circuit Board Design as a Replacement for Kerosene Lamps in Central America"

More than 2.1 billion people live without access to electricity. Another billion live with unreliable access to power. The vast majority of these people use kerosene to light their homes and businesses, but this light source produces a poor quality, smoke-filled illumination and has the potential to cause fires, burns and lung disease. Kerosene lamps produce more greenhouse gasses per unit of illumination than any other common light source. According to a 2005 "Science" magazine article, 190 million metric tones of carbon dioxide are released into the atmosphere annually. And, kerosene is expensive. The cost of kerosene lighting costs more per unit than what is paid in the developed world.

Mr. Barrie plans to bring 21st century Light Emitting Diode (LED) lights to people who are currently using 19th century fuel-based lighting. He plans to do this by developing a universal LED circuit board that will accept a variety of power supplies including photovoltaic panels and battery power or recycled charger power in Guatemala and Nicaragua. A universal circuit board will greatly reduce the costs of LED lighting to the point of being less expensive than kerosene lights. A single watt of LED light provides more illumination than a kerosene lamp. It is better for reading, and solar LED lights are more reliable, lasting approximately 100,000 hours, or 68 years at 4 hours per night. In addition, Mr. Barrie plans to provide data on the costs and benefits of moving from a fuel-based lighting system to high efficiency LED lighting in rural areas. He believes that providing LED lighting will improve the quality of life, reduce greenhouse gas emissions, and remove a major cause of burns and lung disease for a large number of people in rural areas of developing nations while reducing energy consumption.



Dr. Gang Chen
Xinjiang Environment and Natural Resources Conservation Research Institute, Xinjiang, China

"Conserving the Wild Bactrian Camels by Developing Sustainable Desert Communities in Xinjiang, China"

Desertification is the changing of once-fertile land to desert as a result of drought, deforestation or inappropriate agricultural practices. The region of Xinjiang is experiencing the greatest threat of desertification in China. Resulting from desertification, the IUCN has listed the wild Bactrian camel as critically endangered. Adding to the threat of their survival is that the camels live in the Lopnur National Nature Reserve, adjacent to where farmers and herdsmen bring their sheep for additional foraging on wildly growing grasses and plants. In addition, local people use wild grasses and trees for cooking fuel because there is a shortage of conventional energy sources such as coal, gas and electricity.

Dr. Chen will use a series of oral and video presentations to a targeted group of 47 families along the border of the nature reserve to teach the ecological and economic values of his proposed planting and conservation plan. He plans to develop a sheep dung methane pit to provide fuel for cooking, which will enable the natural trees and grasses to grow and support the wild Bactrian camels. The methane pit will generate enough fuel to meet the cooking, hot water, and lighting needs for a family of five, while saving each family about 1.5 tons of firewood consumption per year. In addition, Dr. Chen plans to plant branchy tamarisks (a kind of desert tree) to prevent further desertification and desert-living ci-

tanches (desert ginseng, with a high market value) to increase income for rural families. Without the stresses of sheep grazing and firewood cutting around the camel habitat, the ecological environment for the camels will gradually improve. The citanches and new fuel resources will also improve the quality of life for the people.

Melanie Hart
Simon Fraser University, Burnaby BC, Canada

"Controlling the Peach Twig Borer Moth with Sound Signals"

Sponsored by Doug and Jennifer Moreland

Global exports of almonds and stone fruits, (plums, peaches, apricots, cherries, etc.), totaled more than $1 billion in 2004, according to the USDA. Peaches, nectarines and apricots represent more than $400 million alone. However, every year, part of each crop is destroyed due to the peach twig borer moth. The peach twig borer is found in all the major continents in which stone fruits are grown. Insecticides and pheromone-based mating disruption programs have both proven ineffective. Newly hatched larva immediately burrows into the fruit, avoiding consumption of lethal doses of insecticide. Mating disruption with pheromones fails because moths rely on sound signals to find each other at close range, ignoring the pheromones placed to confuse them.

The "Moth Whisperer," Ms. Hart, hopes to reduce or eliminate the use of insecticides for controlling the peach twig borer by combining the moths' sounds, at levels imperceptible to humans, with their non-toxic pheromones. This approach would prevent males and females from hearing, smelling, and responding to each other, thereby interrupting their reproduction. During this study, Ms. Hart will run trapping trials to determine which sound signals are the best at controlling the moths. Then, the sounds will be digitally recreated, deployed through sound-emitting microchips and placed within the orchard to work in conjunction with pheromone signals to control the peach twig borer. This groundbreaking project will provide an environmentally safe, technologically advanced, and cost-effective way to control insect pests.

Dr. Chi-Hua Ho
Camarillo, CA

"Producing Biodegradable Plastics from Wastewater"

Non-degradable plastics in packaging and other products clog landfills around the world and pose a significant solid-waste disposal problem. In fact, plastics made from petrochemicals are accumulating in the environment at the rate of 25 million tons per year. Recent efforts to combat this problem have focused on biodegradable plastics made from microbially-produced polymers – polyhydroxyalkanoates (PHAs). PHAs are completely biodegradable, but the current costs for producing plastics from PHAs are approximately 10 times higher than conventional plastics. To improve efficiency of PHA production, which would benefit the cost reduction of plastics, it is imperative to use suitable microorganisms with optimized conditions that can rapidly produce high levels of PHAs in wastewater systems.

Using a "Trash" to "Treasure" approach, Dr. Ho plans to transform activated sludge from wastewater (trash) into biodegradable plastics (treasure) by using microbial technology to produce PHAs. She hopes that molecular fingerprinting methods will enable her to determine which microbes are the most successful at producing PHAs. Once she has successfully produced PHAs using activated sludge, the volume of waste disposed of from wastewater treatment plants will be reduced and an economical solution for creating biodegradable plastics will be available. Because wastewater treatment plants are found throughout the world, many nations could use this process, which would minimize a waste disposal problem while simultaneously reducing our dependence on petroleum oil and protecting our environment.

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Sue House

Madison High Academy of Science and Natural Resources, Portland, OR

"Creating a School-Based Permaculture Garden that Provides Hands-On Educational Opportunities, Food for Students, and a Home for Wildlife"

This education grant is sponsored by Reeve Lindbergh

Most students in urban schools today have little or no connection with how their food is grown. When students are asked where their food comes from, most reply, "from the grocery store." Furthermore, they spend less and less time being physically active. Ms. House and other Madison High staff and community members propose developing an outdoor permaculture garden classroom to provide an experiential learning environment that balances the need for healthy, organic food for students with the need for a healthy habitat for wildlife.

Permaculture refers to creating ecologically sound and economically sustainable human communities using a set of design principles. Students themselves will learn how to transform a grassy lawn into a healthy ecosystem that provides food for humans and wildlife. They will experiment with various sheet mulching techniques to create healthy soil for experimental plots, learn cob techniques, and build garden structures from locally available materials while utilizing rainwater catchment. Plants for the garden will be multi-use such as willow to provide fencing and trellis material, flowering plants to attract pollinators, and nitrogen-fixing trees and legumes to improve soil health. Ms. House envisions a garden that provides meaningful educational opportunities for students, while improving the biodiversity of the school grounds. Eventually, the goal is to replace at least some of the nutritionally deficient cafeteria food with organic, sustainably grown food from the garden. In addition, students will make a deeper connection to the food they eat as they watch it go from seed to plate. The project could also benefit the broader community through sharing of underutilized crops. This low-tech educational project will balance human and wildlife needs with that of student learning.

Joshua Kearns

Aqueous Solutions, Huntington, WV

"Providing Safe Drinking Water to Rural Communities in Thailand Using Charcoal Filtration to Remove Pesticides"

This grant in health is sponsored by the Jim and Maureen Lloyd Grant Endowment

According to the World Health Organization, 1.1 billion people, roughly 1/5 of the world's population, are without access to safe drinking water sources. Although nearly 3/4 of the surface of the earth is water, less than 1% is freshwater available for drinking and much of that is unsafe due to biological and chemical pollutants - such as pesticides - that can cause cancer, infertility, neurological disorders, birth defects, etc. Currently, residents of the Pun Pun Farm, an organic farming community of 50 in rural Thailand, collect rainwater run-off from rooftops during the rainy season for their drinking water. It is not possible, however, to collect and store enough water to sustain the community during the dry season. Bottled drinking water is expensive and must be transported over long distances, contributing to fossil fuel consumption. Irrigation canals fed by a nearby lake would provide a reliable year-round source of freshwater, however it is contaminated by agricultural runoff from neighboring farms.

Mr. Kearns plans to develop a household-to-community-scale drinking water treatment system. An earthen kiln will be constructed on-site and will be used to make home-made charcoal from various local sustainably harvested materials such as bamboo, straw, rice husks, nut hulls, etc. He will then test each charcoal sample to determine which is most effective at removing chemical pesticides. In addition, sand filtration and ultraviolet radiation will be used to remove harmful microorganisms. The entire treatment system will be constructed and maintained by the local people using simple, inexpensive and locally abundant materials. Mr. Kearns has also developed a curriculum that details a variety of water purification techniques so that the knowledge from this project can be shared with others. Mr. Kearns believes this is an appropriate technology approach to empowering communities worldwide to ensure access to safe drinking water.

Jennifer Morse

Duke University, Durham, NC

"Predicting the Fate of Nitrogen and the Impact on Water Quality and Greenhouse Gas Emissions from SeaLevel Rise and Wetland Restoration"

This air and water conservation grant is sponsored by Clare Hallward

During the 1960-1980s, many low-lying areas along the Atlantic coastal plain experienced large-scale conversion of forested freshwater wetlands into actively drained agriculture. Currently, many of these farms are being abandoned or restored to wetlands due to economic barriers such as high fuel prices to run drainage pumps, slowly rising sea levels potentially linked to climate change, or through economic incentives to increase wetland habitat. Whatever the motivation, these heavily fertilized soils have a renewed connection to sensitive surface waters, raising questions about the environmental cost-benefit trade-offs. Certainly, restoration of these former wetlands creates wildlife habitats, increased storage of carbon in soil and vegetation, and the potential removal of nitrogen from the soil or surface water through microbial processes. However, under certain conditions, the removal of nitrogen can produce nitrous oxide, a powerful ozone-depleting greenhouse gas.

Using innovative stable isotope tracer methods, Ms. Morse will evaluate the environmental costs and benefits of nitrogen transformations in restored wetlands, with respect to water quality and greenhouse gas emissions. Specifically, she will determine the level of water quality improvement through microbial denitrification, identify which microbial processes are mainly responsible for nitrous oxide emissions, and compare these re-flooded agricultural lands to active farms and forested wetlands. Ultimately, Ms. Morse wants to identify whether and when denitrification benefits water quality at the expense of air quality in re-flooded ecosystems.

Dr. Ganesh Raman

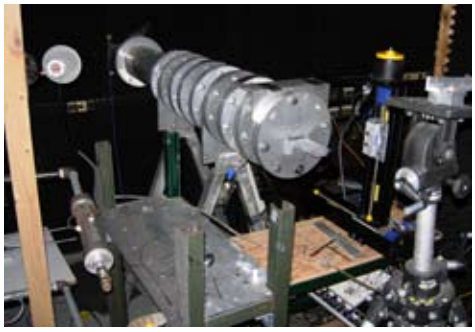
Illinois Institute of Technology, Chicago, IL

"Using High Frequency Sound Waves from Ultrasonic Actuators to Reduce Noise from Commercial Aircraft"

This aviation grant is sponsored by Lycoming Engines

The adverse effect of noise has been the subject of extensive research for many years. Repeated exposure to intense noise can cause permanent hearing impairment, sleep loss, increased stress, and other maladies. Aircraft noise is a problem that affects millions of people who live near airports worldwide. Noise also restricts the maximum utilization of airports and air transportation, which could hamper the economic development of the region. Current noise abatement techniques typically result in the loss of payload capacity and fuel efficiencies, making them undesirable.

Dr. Ganesh Raman proposes a paradigm shift to deal with this issue. Instead of the current passive flow control techniques, like lobed nozzles and chevrons, which are unable to adapt to changing working loads of the aircraft, he plans to develop an active High Frequency Flow Control (HFFC). Large air vortices produced by the engine are responsible for a significant percentage of total jet noise. Powered Resonance Tubes (PRTs) produce a high intensity acoustic tone that disrupts the air vortices, reducing the jet noise; however, they create their own noise. Dr. Raman plans to make the PRT produce high frequency sound instead, which is inaudible to the human ear, but still interferes with the air vortices to reduce the engine noise. An added benefit to this technique is that the HFFC can be turned on during take-offs and landings, when aircraft are noisiest, and off during cruising time, to retain maximum fuel economy. In addition, the high frequency PRT has no moving parts, making the operation simple and highly reliable.



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Grant Recipients, continued from page 7

Shale Rosen

Gulf of Maine Research Institute, Portland, ME and University of Bergen / Institute of Marine Research, Norway

"Evaluating the Use of Midwater Trawls to Reduce the Environmental Impact of Commercial Fishing"

This animal conservation grant is sponsored by Knox Bridges

According to the United Nations Environment Programme, bottom trawls are used to catch more marine fish than any other fishing technique. These large cone-shaped nets are dragged across the seafloor in a process some have compared to clear-cutting of forests. Bottom trawls significantly disturb and sometimes destroy species biodiversity and habitat for the very species the commercial fishery is targeting. It is estimated that 15 million square kilometers are fished with bottom trawls each year, with some areas being trawled an estimated 400 times per year. Concerns about the long term environmental impact of bottom trawling have led the United Nations to establish a global moratorium on the practice in international waters. Yet, fish remain an important source of protein and livelihood for people around the world.

Mr. Rosen proposes a "fish smarter and leave no trace" approach to this problem. During this project, he will study the use of a midwater trawl designed to "fly" behind the boat, just above the sea floor, to catch commercially important bottom-dwelling species like cod, haddock and pollock. Using remote-sensing information from sonar, video and acoustic monitoring equipment, he will study fish behavior in and around the midwater trawl to reduce bycatch and evaluate how the trawl behaves in the water. Mr. Rosen believes that midwater trawls hold promise for allowing people to continue harvesting fish while reducing the negative impact on the marine environment.

Yaron Segal

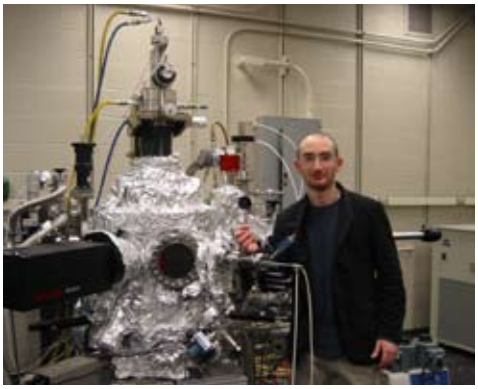
Yale University, New Haven, CT

"Developing High Performance Materials to Directly Convert Waste Heat into Electricity"

This waste minimization and management grant is sponsored by the Cherbec Advancement Foundation

All engines and electrical equipment generate waste heat. About half of all fuel used every second turns into waste heat. Thermoelectric materials are capable of converting waste heat directly into electricity. However, for nearly 40 years, improvement in these materials has been only marginal, making them practical only for specialized applications like power supplies for deep space probes and cooling miniature sensors. When fuel or electricity is not converted fully into work, this waste heat, such as that generated from a laptop computer or hot fumes from a motor vehicle, must be removed to prevent overheating and damage to the device. As this heat is emitted through fans or radiators, it artificially raises the temperature of the surrounding environment and contributes to such phenomenon as the urban heat island.

Yaron Segal plans to test a novel material structure, engineered on the atomic scale, to determine if it can induce a greater electric current when heat is applied to it, through what's known as thermionic emission. The results of this experiment could create a complete paradigm shift and bring about the much-anticipated high-efficiency thermoelectric material that will convert waste heat into electricity that can be routed back and used as an additional energy source. If thermionic effects are found in this structure, the energy efficiency of devices that will employ it could be double or more compared to existing devices. This would be especially useful in air and space vehicles where the weight of fuel is a considerable design limitation.



Spectrum of Aviation Hangar Party Highlights

A cool cloudy evening didn't faze the hearty bunch of aviation enthusiasts who came out for the Lindbergh Foundation's "Spectrum of Aviation Hangar Party" on Saturday, September 27 at the Golden Wings Museum in Blaine, Minn.

"Many people were attracted by the stellar list of prominent aviation leaders scheduled to speak, including **Linden Blue** and **Larry Williams**," said Lindbergh Foundation Chairman John King, King Schools, Inc. "Add to that the BRS rocket launch and the intrigue of the latest infrared technology to be featured by **Patrick Farrell** of Forward Vision and you've got a block-buster line-up. The folks forgot about the cold, though, when the Cirrus *Perspective*, and Cirrus Design CEO **Alan Klapmeier** arrived." The doors to the new plane were open and it was plugged in so everyone could see it up close and personal.

Linden Blue, chairman of Spectrum Aeronautical, addressed the technological innovations used in manufacturing airplanes over the years. The new composite material used on Spectrum Aeronautical planes is not only stronger, but also lighter weight, making them much more fuel efficient than aluminum and steel planes. Remembering "Rosie the Riveter," Blue explained that decreasing the number of parts that are punched through the body of the plane makes the planes stronger and provides fewer opportunities for corrosion. Blue's company builds one-piece wings and fuselages, which translates into safer, and more fuel-efficient flying.

"Aviation has a bright future," said Klapmeier, "but it will come as a result of new technology."

Alan Klapmeier spoke enthusiastically about the dichotomy of new aviation technology within the space of the beautiful classic airplanes of days gone by. "The Lindbergh Foundation is a unique organization because of its dedication to the environment and new technology," Klapmeier said. He went on to say that he believes technology can lift the barrier to entry by making flying easier and safer, and in this way, more people will be drawn to aviation.

Master of Ceremonies Miles O'Brien commented that technology is drastically changing general aviation in ways that were unimaginable just a few years ago. "The latest cool thing to reach the kinds of cockpits I sit in is FLIR. I am not talking about that which lies below the ceilin'," O'Brien joked. "I am talking about Forward Looking Infrared Radar. It is not just for black helicopters anymore."

Patrick Farrell, CEO of Forward Vision, then took the stage and discussed the new infrared technology that allows pilots to see in the dark, through snow, fog, and rain. Farrell pointed out that many of the major causes of aviation accidents are related to visibility, and Forward Vision's EVS 100 is something that can be put on every plane, not just the business jets. A video demonstrated the technology and its high level of detail. In the video, Farrell was able to point out a herd of mule deer in a field at night.

Patrick Farrell (left) spoke to a group about Forward Vision's Forward Looking Infrared Radar. After the event, Farrell said, "We were honored to participate and are inspired by the ideals that are represented by the Lindbergh Foundation. These ideals will remain timeless."

Larry Williams, CEO of Ballistic Recovery Systems, capped off the evening with the story of Icarus's fall from the sky and explained that BRS is focused on "the fall." Williams pointed out that a centuries old idea, like parachutes, has led to a whole-aircraft product that has saved 214 lives. As a director of the Lindbergh Foundation, Williams spoke eloquently, weaving parachutes and Lindbergh history together, including the fact that Charles Lindbergh himself used a parachute several times. "I feel Mr. and Mrs. Lindbergh would be proud to see the growth of aviation, the innovations of today and the expressed commitment and concern by our industry to realize their vision of a balance between the technological advancements they helped pioneer, and the preservation of the human and natural environments they cherished," said Williams. "The Lindbergh's helped establish and certainly influenced aviation as we know it today."

Before the evening concluded, Foundation President Knox Bridges announced that the 2009 Lindbergh Award Celebration would be held at the EAA Eagles Hangar in Oshkosh, Wisc., on May 16, 2009, and he invited Elissa Lines from EAA to join him on stage to greet the audience. "Oshkosh is all about innovation," said Lines. "So we feel that Oshkosh is the perfect place for the Lindbergh Award event. EAA is where innovation and technology take flight."

A drawing was held for two tickets to the 2009 Lindbergh Award Celebration honoring Lester Brown and Terry and Mary Kohler at the EAA Eagles Hangar in Oshkosh, Wisc., on May 16. Knox Bridges presented the winning ticket to Karen Hager.

Bird Song Project, continued from page 3

help the students understand the human connection to their natural environment, each group of students were arranged into rows. Each row of students saw a photo, learned some facts about a particular bird and then learned that bird's song. Finally, an actual recording of the bird song was played for the students to compare how close the human interpretation came to the real thing. Once each of the rows had learned a bird song, they sang together in a Dawn Chorus. To end this portion of the presentation, a recording of an actual Dawn Chorus was played. In addition, slides of various composers and musicians that have been inspired by bird song and a selection of their bird-inspired music was played for the students. To highlight how birds are also influenced by human sounds, a video clip from a David Attenborough program showed the lyre bird, which can mimic virtually any sound it hears – including the shutter of a camera and chainsaws.

Students study their Missouri Song Birds Field Guide.

"The students really enjoyed the presentation," said Dr. Coffman. "And Dr. Sandfort (superintendent of the Lindbergh School District) commented that we had really hit the mark in engaging that age group of students."

Speakers from the St. Louis Audubon Society and the Missouri Department of Conservation complemented the program with an "Avian Acoustics" workshop focused on creating different bird songs. Students were given balloons to blow up and make bird sounds as the air escaped. The "Beaks and Bills" work station demonstrated different strategies birds use to eat and what they use to eat with. This hands-on activity invited children to use chopsticks or tweezers to pick up small bits of food. "I think this is pretty cool," one fifth-grader told the *South County Journal* in St. Louis, Mo. "I studied birds in third grade ... . We were just talking about the bird songs and the vocal chords of the birds and how they make their sounds."

Following the program, Dr. James Sandfort said, "It was a great project for the students and a great day to reinforce the partnership between the Foundation and our district." Dr. Coffman added, "For me, the best part of the day was to bring all the people involved in the project together and let each of them highlight their expertise and synergize. The result produced was greater than the sum of its parts. The interdisciplinary nature of the Bird Song Project is the aspect that I enjoy the most."

The Results

The results from this project indicated that 70% of the students participating in this curriculum found the technology component such as the iPods, recording microphones, or the Mixcraft music software to be their most favorite part of the Bird Song Project overall. Comparing the pre- and post-surveys, 40% more students were able to correctly answer the question, "Why do birds call?" and more than half of the students listed animals as their favorite topic in either science or nature. The music component of the project seems to have had the greatest success and seems to prove that an interdisciplinary approach can affect overall literacy and create new avenues of interest for students. The post-survey results revealed that students doubled their vocabulary used to describe music, and when asked to describe "something in music that you would like to learn more about," 2/3 of students offered a specific answer including: learning to play an instrument (25%), learning more about music theory or composition (25%), and learning about different types of music (15%).

The future of the Bird Song Project looks bright. Dr. Coffman, science and music experts, and the LEAP teachers came up with several ideas to expand the project. In the next implementation, Dr. Coffman would like to organize a digital library of songs and calls that are paired by species and strongly exemplify the qualities that are normally used to distinguish a song from a call. This would help students better recognize the difference between the two sounds.

A spin-off project includes the expansion of the sound library to include other animals, like whales, frogs and insects. In fact, Dr. Coffman and 1989 Lindbergh Grant Recipient Gordon Hempton, known as "The Sound Tracker," may be collaborating to develop the sound library.

Visit Margaret Coffman's page on the Lindbergh Foundation web site to see the fascinating lyre bird video clip and to hear samples of student compositions.

Honor Roll: August 15 - November 7, 2008

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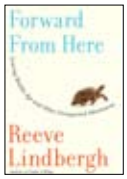

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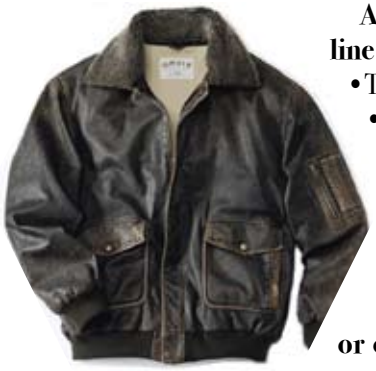

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2009 Lindbergh Award Celebration

Join us as we honor **Lester Brown**, president and founder of the Earth Policy Institute and **Terry and Mary Kohler**, Owners of Windway Capital Corp., with the 2009 Lindbergh Award. The Lindbergh Award recognizes significant contributions toward balancing technology with the care and protection of our environment.

Date: Saturday, May 16, 2009
Place: EAA Eagles Hangar
Oshkosh, Wisconsin

Watch for more details on our web site at www.lindberghfoundation.org, or in the E-Flyer newsletter.

Happy Holidays

2150 Third Avenue North, Suite 310
Anoka, MN 55303-2200
Phone: (763) 576-1596; Fax: (763) 576-1664
e-mail: info@lindberghfoundation.org
www.lindberghfoundation.org