Environment and Natural Resources Trust Fund
2019 Request for Proposals (RFP)

Project Title: **ENRTF ID: 045-AH**

Aircraft Noise Pollution MN Valley National Wildlife Refuge

Category: H. Proposals seeking $200,000 or less in funding

Sub-Category: A. Foundational Natural Resource Data and Information

Total Project Budget: $ 192,544

Proposed Project Time Period for the Funding Requested: June 30, 2021 (2 yrs)

Summary:

Accurately measure aircraft noise pollution levels to provide insight into what changes should be implemented to preserve and protect the home of waterfowl, migratory birds, fish, and resident wildlife.

Name: Jacob Swanson

Sponsoring Organization: Minnesota State University - Mankato

Title: Assistant Professor

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Location

Region: Metro

County Name: Hennepin

City / Township: Bloomington, Eagan, Burnsville

Alternate Text for Visual:

Sound. Song. Survival. Compelling images of MN wildlife and a statement that sound levels affecting wildlife are much lower than sound levels that affect humans. Further measurements are needed.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%
____ If under $200,000, waive presentation?			

PROJECT TITLE: Aircraft Noise Pollution in the MN Valley National Wildlife Refuge

I. PROJECT STATEMENT

In summary, we seek to deploy a noise measurement network with 15 sound sensors in the Minnesota Valley National Wildlife Refuge to collect data that can be used to estimate the impact of aircraft noise pollution on wildlife. Data will be collected for a year and results will be compared with modeled "predictions" made with commercially available software that is already used by the FAA and with remote monitoring stations that are located in residential areas. Analyses will provide insight into what changes should be implemented to preserve, protect, and improve the home of a diversity of waterfowl and other migratory birds, fish, and resident wildlife.

To elaborate, this project will deploy a monitoring network using sound sensor technology to inform the decision-making process taken to protect our natural and cultural resources that are a part of the Minnesota National Wildlife Refuge. The specific information we would gather concerning the effects of anthropogenic noise on wildlife offers a valuable resource to assist scientists, industry, and natural-resource managers in predicting potential outcomes of noise exposure. One of the major sound pollution sources is the Minneapolis Saint Paul International Airport. For current sound measurement metrics the FAA uses guidelines that focus on human responses to noise. The FAA has thresholds as high as 65 dBA when dealing with human responses. However, it is well documented that adverse wildlife responses begin at approximately 40 dBA. Rather than use measured sound levels, officials are instructed to use available published information. This information is lacking with respect to the species that the Wildlife Refuge protects and the noise levels expected. This project will address that issue by achieving the three main objectives:

1. Improve the understanding of damaging sound pollution variability within the Minnesota Valley National Wildlife Refuge with clear meaningful conclusions.

2. Expand the availability of understandable sound quality data to inform decisions, especially regarding aviation noise impacts on the specific species that live in the wildlife refuge.

3. Provide a noise network that Minnesota Valley National Wildlife Refuge can continue to use to determine changing effects of noise pollution.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: *Deploy 15 noise measurement instruments that continuously collect data.*
Install noise measurement instruments in strategic locations to collect noise pollution sound levels. Placement will be backed by simulated results with the same software the FAA uses.
ENRTF BUDGET: $100,000

Outcome	Completion Date
1. Laboratory and/or field results showing performance and accuracy of instruments	*Jan 1st, 2020*
2. A map of appropriate strategic sensor locations generated from modelling results	*Jan 1st, 2020*
3. A fully-deployed, sustainable noise measurement network that produces accurate raw data	*Jan 1st, 2020*

Activity 2: *Collect data for a year, analyze collected data, and make meaningful, data-based conclusions*
All data that is collected will be in a raw format. We will analyze and assemble the data into formats and averages that wildlife and aviation officials can easily use to make informed decisions. Transform that data into "day night average" sound levels, which is the metric used by the Metropolitan Airport Commission (MAC) and validate MAC noise contour extrapolations.
ENRTF BUDGET: $65,000

Outcome	Completion Date
1. Comprehensive data analysis that is usable by Wildlife Refuge officials	*Jan 1st, 2021*
2. Noise contour model that shows the impact noise pollution has on the wildlife	*Jan 1st, 2021*
3. Knowledge of validity of current MAC noise contours in the vicinity of the Wildlife Refuge	*Jan 1st, 2021*

Activity 3: *Information dissemination to wildlife officials and the public*
Analyzed data will be disseminated to groups who will benefit. Some of these groups include to the MSP Noise Oversight Committee, stakeholders of the MN Valley National Wildlife Refuge, and the MSP Fair Skies Coalition. The scientific community will broadly benefit from the modelling and measurement lessons learned. Create posters to be displayed so that the general public can understand the impacts and conclusions of the work.
ENRTF BUDGET: $27,544

Outcome	Completion Date
1. Published paper on significant outcomes with possible routes of action	*May 1st, 2021*
2. Presentation by primary personnel involved in this project to the MSP Noise Oversight Committee, and the MSP Fair Skies Coalition	*May 1st, 2021*
3. Posters and brochures available for Minnesota Valley Wildlife Refuge visitor center	*May 1st, 2021*

III. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
n/a			

B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Role
n/a			

IV. LONG-TERM- IMPLEMENTATION AND FUNDING: We will seek continuation funding so that Minnesota Wildlife Refuges can continue the data collection to use in future studies while using the information gathered to make informed decisions. In parallel with this work, a proposal will be submitted to a FAA grant proposal under FAA-12-01 – Chapter I. FAA Research Grants Program, Technical Areas of Research #7. The proposal will support extension of our work from the wildlife refuge to the residential communities surrounding the area. While there are currently remote monitoring stations making such measurements, there are concerns about the noise thresholds used, the metrics reported, and the independency of the results. Data, models, and lessons learned will increase opportunities for successfully procuring this additional funding.

V. TIME LINE REQUIREMENTS: This project will take two years to complete We are planning for six months of set-up and purchasing, one year of gathering data, and six months to compile data and disseminate data.

2019 Detailed Project Budget

Project Title: Aircraft Noise Pollution in the MN Valley National Wildlife Refuge

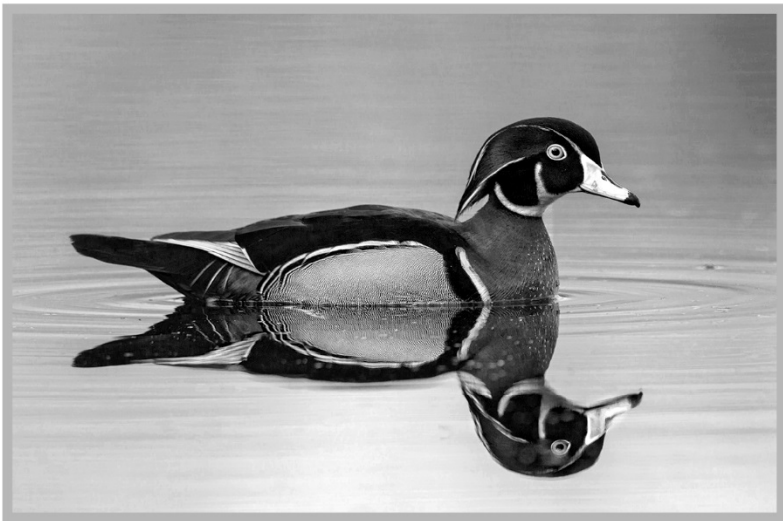
IV. TOTAL ENRTF REQUEST BUDGET 2 years

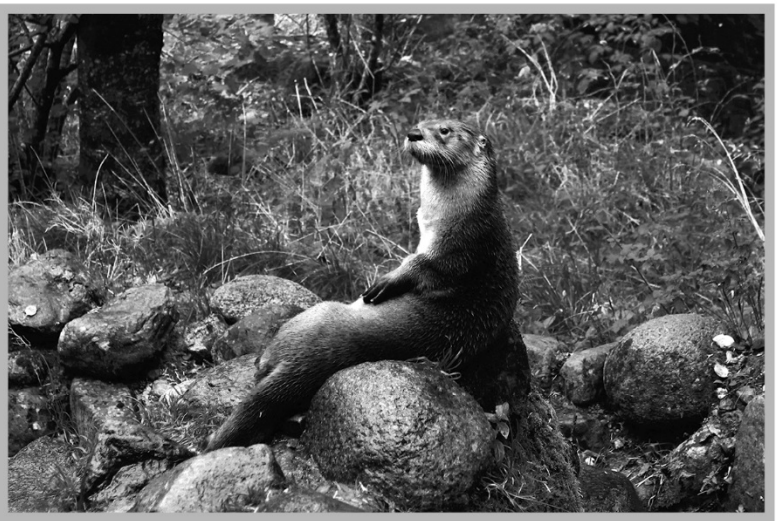
BUDGET ITEM	AMOUNT
Prof. Jacob Swanson, Project Manager, (82% salary, 18% benefits); 15% FTE for 2 years	$ 43,424
3 Undergraduate Research Assistants (92% salary, 8% benefits, $12.50/hr); 75% FTE for 2 years	$ 42,120

Professional/Technical/Service Contracts:	
Equipment/Tools/Supplies:	
15 noise monitoring systems @$5,000/each	$ 75,000
Additional supplies required for noise station installation	$ 10,000
FAA software and GIS map making software	$ 10,000
High processing power computer for running FAA / GIS simulations	$ 10,000
Acquisition (Fee Title or Permanent Easements): n/a	
Travel:	$ -
Travel to location for sensor deployment, many return trips for maintainence and battery changing, reinbursed at MinnState rates	$ 2,000
Additional Budget Items: n/a	$ -
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST	=$ 192,544

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period		
Expect to submit FAA grant proposal under FAA-12-01 – Chapter I. FAA Research Grants Program, Technical Areas of Research #7	$ 250,000	Unsecured
Other State $ To Be Applied To Project During Project Period: *n/a*		
Minnesota State University Mankato overhead waiver		Secured
In-kind Services To Be Applied To Project During Project Period:		
Assistance with sensor deployment from local citizen scientists		Secured
Funding History:		
2017 LCCMR, Deploying new technology to understand urban air pollution	$ 700,000	Secured
MNSCU leveraged funds for equipment purchases (AY 2017)	$ 17,000	Secured
MSU-Mankato Faculty Research Grant (supported some preliminary work related to this proposal)	$ 4,995	Secured
Remaining $ From Current ENRTF Appropriation:*n/a*	$ -	





Sound. Song. Survival.

Documented responses to a variety of anthropogenic noise sources have included shifts in physiology such as impaired hearing and elevated stress hormone levels, alteration of key behaviors in the form of foraging, vigilance and movement changes, and interference with the ability to detect important natural sounds.

Literature surveys show that terrestrial wildlife responses begin at noise levels of approximately

40 dBA which is much lower than the threshold the FAA uses at 65 dBA

Nosie pollution is pervasive, but we can take measures to mitigate. **Let's start by measuring noise pollution at levels that start to affect wildlife species, not at already damaging levels.**

I. PROJECT MANAGER QUALIFICATIONS

Dr. Jacob Swanson is an Assistant Professor of Engineering in the **Twin Cities Engineering Program** in the Department of Integrated Engineering at Minnesota State University Mankato. He is also an Adjunct Assistant Professor in the Department of Mechanical Engineering (ME) at the University of Minnesota. He was previously a Research Associate in the Department of Engineering at the University of Cambridge, UK and before that, a graduate of UMN's ME Department. Prof. Swanson is internationally recognized for his work on emissions from engine combustion engines, including those from gas turbines. He has published 36 papers and given more than 80 conference presentations on these topics. He is currently advising about 25 students as part of his ENGR Design course. He has 3-4 other external projects supporting about eight undergraduate students. He annually supports, by co-advising, on average 1-2 graduate students in the Particle Technology Laboratory and Engine Research Labs at the University of Minnesota. His specific experience, as related to aircraft, includes a significant amount of real world, field experience measuring aircraft emissions all over the world:

- Participation on in UK "SAMPLE" campaigns in the United Kingdom (UK) and Switzerland aimed at determining a methodology for measuring aircraft gas turbine particulate matter
- Operation of the Cambridge Intermediate Pressure Gas Turbine Combustion (CIPCF) facility (supported by Rolls Royce) at the University of Cambridge
- Participation in US EPA "VARIAnTII" sample campaigns in Tennessee and Minnesota that were also aimed at determining a methodology for measured aircraft gas turbine particulate matter.

II. ORGANIZATIONAL DESCRIPTION

Twin Cities Engineering (TCE) is a program of the Department of Integrated Engineering of Minnesota State University, Mankato. TCE has the purpose of expanding the pool of qualified engineers in the Twin Cities Metro area by establishing an affordable, accessible, and unique option for the region's engineering students. TCE offers an inclusive and innovative learning experience that has attracted non-traditional students and veterans at a higher rate than traditional students. The BSE degree program includes several features that differentiates it from traditional engineering degree programs. TCE addresses the entire learning experience and not simply one component of the curriculum. Five features, designed to produce desired attributes in BSE graduates, are as follows.

- Trans-disciplinary thinking
- Industry-sponsored, project-based-learning
- Experiential learning in context
- Competency-based assessments
- Significant exposure to professionalism, design, creativity, and innovation