

**Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 029-A

Geospatial Airborne Sensor Survey to Manage Water Resources

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 3,126,779

Proposed Project Time Period for the Funding Requested: 3 years, July 2017 - June 2020

Summary:

The Project will capture real time geospatial sensor data; actively manage specific watershed projects; optimize water quality; and minimize pollution attributable to ditch construction using unmanned/manned Lidar equipped aircraft.

Name: Rex Hammerback

Sponsoring Organization: Northland Aerospace Foundation

Address: 308 Demers Ave
East Grand Forks MN 56721

Telephone Number: (218) 399-3939

Email rex.hammerback@northlandaerospace.com

Web Address _____

Location

Region: Northwest

County Name: Beltrami, Clearwater, Itasca, Koochiching, Mahnommen, Marshall, Pennington, Polk, Red Lake, Roseau

City / Township:

Alternate Text for Visual:

Picture 1 is the map of where activities will take place. Picture 2 is what the imagery collected will look like from collection to dissemination. Image 3 is a map of all 10 counties that the Red Lake Watershed District oversees.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____ %



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *Geospatial Airborne Sensor Survey to Manage Water Resources*

PROJECT TITLE: Geospatial Airborne Sensor Survey to Manage Water Resources

I. PROJECT STATEMENT

The real time capture of geospatial sensor data (including bathymetric Lidar) through the use of unmanned (drone) and manned aircraft will result in the ability to efficiently target, prioritize, and measure water management activities to restore and protect water quality. The expected outcome is a dramatic increase in the quality of water resources.

The Red Lake Watershed District encompasses over 316.5 miles of legal ditches. All relevant ditches will be surveyed. All of the 46 other Watershed Districts in Minnesota have ditches that play a major role in the impact on water quality in Minnesota. Two specific studies that highlight that impact are set forth in this Statement below. The data capture activities and outcomes of this project will benefit all Watersheds.

The Red Lake River channel downstream of the confluence of county ditch 96 (Pennington County) near the town of St Hilaire has serious observable downstream issues with regard to turbidity and suspended solids levels that exceed state water quality standards. The exceedance of water quality standards mainly occurs during periods of high ditch flowage events which generate nonpoint runoff and stream bank erosion, which in turn causes the high levels of turbidity. Several Red Lake Watershed District ditches have significant stream bank stability problems and suffer from various buffer zone encroachments. The overall effect of these issues results in serious negative impacts on water quality and aquatic life.

There is an immediate need to employ technological advances in Lidar bathymetry and geospatial sensors to capture real time data for the active management of these watershed challenges. Water penetrating Lidar profiles of ditches will result in data needed to engineer grade stabilization of these ditch projects. The data collected through the use of these advanced technologies will be used to monitor the success of ditch improvement projects, application of two stage ditch design, erosion control projects and the installation of best management practices such as side water inlets and mandated buffer strips. At the completion of the project, the development and implementation of these new technologies for the enhancement of water resources will provide a road map for statewide management of ditch erosion issues.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Project Setup and Initialization

Budget: \$2,174,459.50

The first year of the project will include activities related to initial setup of the operational infrastructure which will be needed to capture the data and complete the project. It will include all activities for establishing routine business practices and fiscal controls. Initial flights of unmanned and manned sensor equipped aircraft will be conducted to calibrate and operationalize sensors and software. Capture plans will be developed and sorties will be scheduled to begin data capture. The expected outcome will be the capture of all baseline data that can be then used for the implementation of management and corrective pollution control strategies to reduce water pollution due to erosion.

Outcome	Completion Date
1. Procurement and Hiring	October 1, 2017
2. Operational Protocols and Calibration Flights	January 1, 2018
3. Capture of Baseline Data/ Formulation of Corrective Action Plans	June 30, 2018

Activity 2: Data Capture and Corrective Action Plan

Budget: \$476,159.50

The second year of the project will primarily encompass flight operations and data capture directly related to action and management plans. Data collected during the 2nd year will be compared to baseline data to calculate changes in channel geometry that indicates active erosion and sedimentation. This data will be used to plan the implementation of a corrective action plan and engineered changes. Data capture will continue along with qualitative assessments of the data and airborne vehicles operations.

Outcome	Completion Date
1. Completion of engineered solutions and modifications	August 2018



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *Geospatial Airborne Sensor Survey to Manage Water Resources*

2. Monitoring and cataloging of new modification baseline data	<i>November 2018</i>
3. Assessment of modification/change data and evaluation of progress	<i>May 2019</i>

Activity 3: Assessment, Comparison and Dissemination

Budget: \$476,159.50

The bulk of year three activities will focus on assessment and comparison of baseline data with expected erosion control outcomes. Determinations will be made as to the overall success of ditch improvements with regard to enhancements to water quality and benefits to water resources. Finally, the project will “package” results for the purposes of dissemination to third parties such as watersheds and the Minnesota Department of Natural Resources. Educational programs for training geospatial graduates will be finalized.

Outcome	Completion Date
1. Assessment of the success of erosion control data and outcomes	<i>August 2019</i>
2. Comparisons of quality of data/relevance of data and relative platforms efficiencies of unmanned and manned.	<i>August 2019</i>
3. Dissemination of “packaged” materials including protocols, procedures and outcomes to third parties for educational and informational purposes	<i>October 2019</i>

III. PROJECT STRATEGY

A. Project Team/Partners

The project team includes the Northland Aerospace Foundation (NAF), Northland Community and Technical College (NCTC) and the Red Lake Watershed District (RLWD). This will be the first project team in Minnesota to use “state of the art” geospatial sensors (cameras), Lidar and Bathymetric Lidar (penetrates water to measure and map stream beds) in unmanned (drones) and manned aerial platforms. The activities and outcomes will forever change the way ditch erosion is managed and corrected in the State of Minnesota. Northland Aerospace is a Minnesota non-profit with IRS 501 c3 status formed to act as a “bridge” between the College (NCTC) and third parties interested in engaging in projects with significant educational components. NCTC is a premier aerospace educator with a 50-year history in Northwestern Minnesota. NCTC is currently the only nationally certified and accredited college that offers an unmanned aerial systems maintenance technician training program in conjunction with a geospatial intelligence training curriculum. Geospatial expertise in the operation of unmanned and manned aerial platforms will be invaluable to the success of this project. The Red Lake Watershed District is the largest watershed district in Minnesota. The dedication of the watershed team members to utilize new technology and the implementation of new technology to manage significant water quality problems and water resources will form the catalyst for a new and innovative approach to resource management. Partners are Northland College (\$867,868.50) to conduct unmanned operation, data collection/dissemination, and the Red Lake Watershed District (\$247,657.50) to develop the pollution control action plan.

B. Project Impact and Long-Term Strategy

It is expected that the data captured, processed and applied to ditch erosion and stream bed pollution as a result of the Project will provide a new path forward in the long term effort to improve water quality in the State of Minnesota. The establishment of data baselines and the timely capture of relevant geospatial data, including Lidar and Bathymetric Lidar, will provide solid scientific bases for focused solutions to ditch sediment/runoff pollution. It is further expected that the information generated will be shared with all water resource stake holders for use in future efforts to make relevant and timely decisions in ditch construction/alterations.

C. Timeline Requirements

The Project is a three-year project. Three years will be needed to capture baseline data, apply data to identified pollution issues; implement engineered changes and to then monitor and record outcomes. In addition, it is expected that the dissemination of “lessons learned” to other water resource stakeholders will require the use of the remaining time available after the conclusion of the third summer of work.

2017 Detailed Project Budget

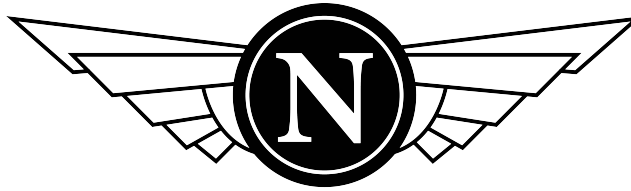
Project Title: Geospatial Airborne Sensor Survey to Manage Water Quality

IV. TOTAL ENRTF REQUEST BUDGET 3 years

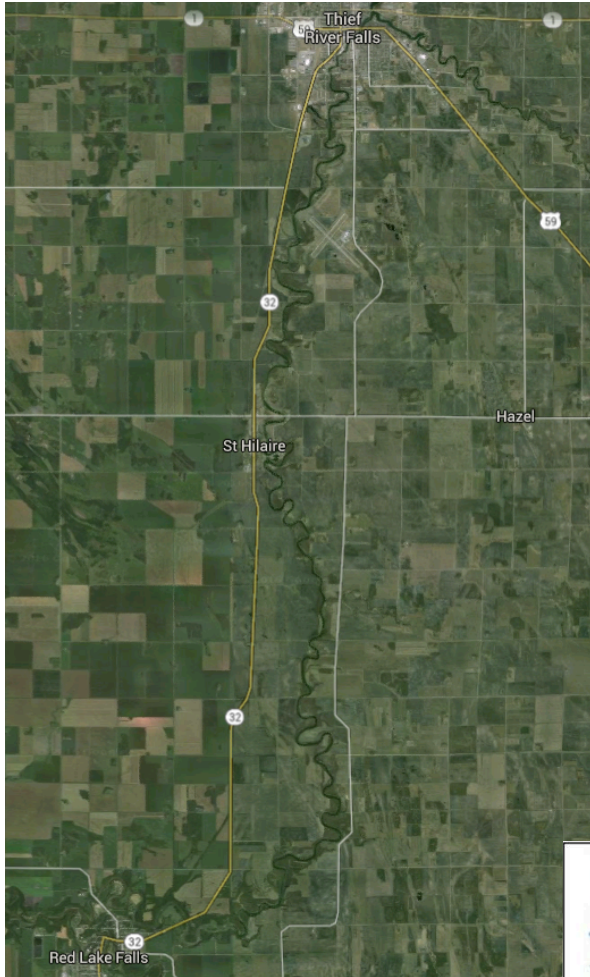
BUDGET ITEM	AMOUNT	
	FTE / Year	3 Yr Project
Personnel:Formula = "Per Hour Rate" x "37% Fringe Rate" x "2000 Hours Per		
Principal Investigator "PI" - The Principal Investigator will oversee the implementation of project activities, including required reporting of grant activities, scheduling, contract management, data collection, budgeting, and day-to-day management of grant activities. (1 FTE - 1 Person)	\$37.50 / hour - 1 FTE	\$ 308,250.00
Water Quality Coordinator - (.5 FTE - 2 Personnel) In charge of planning and implementing the district's water quality related activities, including water quality sampling, continuous water quality monitoring, flow measurements and continuous stage/flow monitoring	\$30.00 / hour - 1 FTE	\$ 246,600.00
Aerial Systems Pilot - Conduct manned and unmanned flight operations in support of imagery collection for project requirements. Responsible for operational planning, safety, flight reporting, compliance with Federal Aviation Administration requirements, and site selection based on environmental conditions. (.5 FTE - 2 Personnel)	\$32.50 / hour - 1 FTE	\$ 267,150.00
Geospatial Intelligence Analyst - Provide analytical skills sufficient to review and compare data, remote sensing software, Arc Map/GIS for photo interpretation, digitizing, manage electronic spreadsheets to compile lists or track projects and activities, correspondence and presentations showcasing project results. (.5 FTE - 2 Personnel)	\$32.50 / hour - 1 FTE	\$ 267,150.00
Imagery Analysis Interns - Must have completed one year imagery analysis certificate and will directly support the Geospatial Intelligence Analyst (.2 FTE - 5 Personnel) (Reduced Fringe Calculated - 15%)	\$15.00 / hour - 1 FTE	\$ 103,500.00
Project Data Coordinator - Responsible for data collection and management for both grant project activities as well as grant reporting. Reporting requirements include fiscal, compliance, and activity reporting as required by the granting organization. (.5 FTE - 1 Person)	\$27.50 / hour - .5 FTE	\$ 226,050.00
Professional/Technical/Service Contracts:		
Helicopter Lease- \$1000 per hour at 50 hours annually		\$ 150,000.00
Small UAS Software Integration		\$ 100,000.00
Equipment/Tools/Supplies:		
Small UAS Platform- DJI Matrice 100 (\$3,300), Guidance System (\$1,000)		\$ 4,300.00
Small UAS Sensor/IMU/GPS (\$4,000)		\$ 4,000.00
Small UAS Lidar/IR/RGB System- Velodyne Puck		\$ 8,000.00
Lidar System- (Strut Mounted)		\$ 700,000.00
Bathymetric Lidar- (Strut Mounted)		\$ 700,000.00
Software Purchase and Integration- ArcGIS		\$ 32,000.00
Travel:		
Mileage=\$3,877.50/Meals= \$825.00		\$ 4,702.50
Mileage= 846.00		\$ 846.00
Mileage= \$2,115.00		\$ 2,115.00
Mileage=\$1,057.50		\$ 1,057.50
Mileage=\$1,057.50		\$ 1,057.50
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$	3,126,778.50

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ To Be Applied To Project During Project Period:	N/A	N/A
Other State \$ To Be Applied To Project During Project Period:	N/A	N/A
In-kind Services To Be Applied To Project During Project Period:	\$ 553,293	
Funding History:	N/A	N/A
Remaining \$ From Current ENRTF Appropriation:	N/A	N/A



NORTHLAND AEROSPACE FOUNDATION



Left Image: This map shows the section of Red Lake River between Thief River Falls and Red Lake Falls where the largest portion of the project will be monitored.

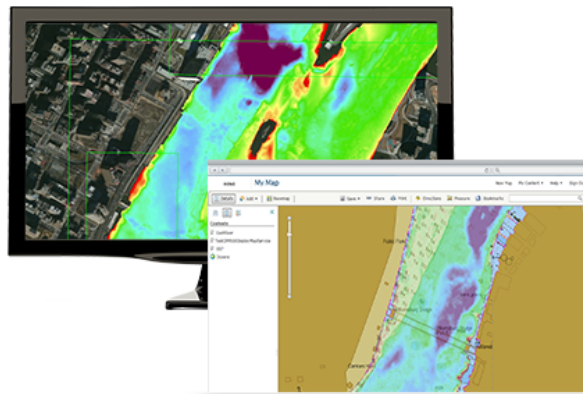
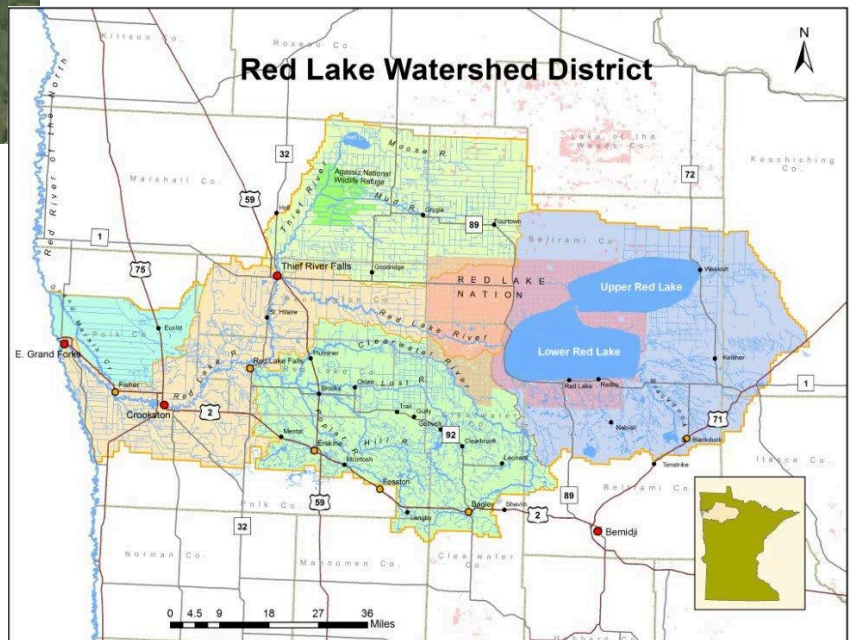


Image Above: This is a sample of what Bathymetric Lidar can collect and process through the ArcGIS software so that it can be monitored and disseminated.

Right Image: This is the Red Lake Watershed District map showing the 10 counties it covers as the largest district in MN.





Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *Geospatial Airborne Sensor Survey to Manage Water Resources*

Project Manager: Rex Hammarback, Northland Aerospace Foundation, Executive Director

Qualifications:

Rex Hammarback has a 40 year history of aerospace education and business management experience. He has served as the chief operational officer for aerospace education foundations and has been responsible for all business activities. He has been the lead corporate officer for delivery of multi-million dollar training programs with contracts in excess of 100 million dollars. Rex Hammarback has had careers in professional aviation and business law. He started his career in aviation as a flight instructor and charter pilot operating under federal aviation regulations. He became an airline transport pilot at the age of 23. He has been a chief pilot for air taxi operations and agricultural aircraft operations under the federal aviation regulations. He has over 5,000 hours of flight experience in over 90 different types of aircraft, including gliders, ultralights, helicopters and jets. He graduated with honors from North Dakota State University where he majored in business administration. He holds a law degree from the University of North Dakota. He is currently involved in providing managerial leadership for the unmanned training and educational sales activities of the Northland Aerospace Foundation. The Aerospace Foundation serves as a "bridge" for the Northland Community Technical College (NCTC) to third parties who have program needs with a strong educational component.

Project Responsibilities:

The project manager will be responsible for providing overall project management and operation direction for the project. The project manager will support hiring activities and supervise all flight operations. The project manager will oversee all procurement and contract management duties. He will monitor the business infrastructure, recording keeping, required reporting and communication deliverables. He will keep and maintain project work plans, amendments to work plans and final reports. He will organize all post operational /educational materials and disseminate those materials to stakeholders. (NAF currently funds Mr. Hammerback ½ time/.5 fte)

Organization Description:

Northland Aerospace is a collaborative partnership between Northland Community and Technical College (NCTC) of Thief River Falls, MN and the Northland Aerospace Foundation (NAF) of East Grand Forks, MN. NCTC is the educator and the NAF is the business contracts administrator for third party projects. Northland Aerospace's mission is to provide and participate in advanced technological programs that lead the geospatial intelligence training world.