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# REU Site: Sensor Science and Engineering

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## Preview of Award 0848014 - Final Project Report

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### Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	0848014
Project Title:	REU Site: Sensor Science and Engineering
PD/PI Name:	John F Vetelino, Principal Investigator Nuri Emanetoglu, Co-Principal Investigator
Recipient Organization:	University of Maine
Project/Grant Period:	05/01/2009 - 04/30/2013
Reporting Period:	05/01/2012 - 04/30/2013
Submitting Official (if other than PD\PI):	Nuri Emanetoglu Co-Principal Investigator
Submission Date:	07/09/2013
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	Nuri Emanetoglu

### Accomplishments

#### \* What are the major goals of the project?

This reporting period covers a one year no-cost extension to the REU site project. Four REU 2011 fellows, two of them women students, continued their REU projects during the academic year.

#### \* What was accomplished under these goals (you must provide information for at least one of the 4

**categories below)?**

Major Activities: Four REU fellows, two of them women students, continued their research from the summer of 2011. The research topics were:

- Peroxide based explosive detection using a lateral field excited (LFE) sensor
- Saxitoxin detection using an LFE sensor
- AlN thin film deposition and characterization for LFE thin film resonator (TFR) sensors
- Passive harmonic wireless tags for juvenile amphibian tracking using harmonic direction finding radar

Specific Objectives: An optimized design for the passive harmonic wireless tag was invented, which improved the range of the harmonic direction finding radar unit developed during the summer of 2012 (see first year report for NSF grant 1156611 REU Site: Sensor Science and Engineering).

Significant Results:

Key outcomes or  
Other achievements:

**\* What opportunities for training and professional development has the project provided?**

Four REU fellows, two of them women students, continued their research from the summer of 2011, providing them with additional exposure to research methods and improving their laboratory skills.

**\* How have the results been disseminated to communities of interest?**

Two conference papers were presented and published on the passive harmonic wireless tag design and optimization research carried out by the REU fellow Evan Kus. One journal paper was submitted to Sensors and Actuators B on peroxide based explosive detection using a lateral field excited bulk acoustic wave sensor.

## Products

### Books

### Book Chapters

### Conference Papers and Presentations

H. Aumann, E. Kus\*, B. Cline and Nuri W. Emanetoglu (2012). *A 5.8 GHz Folded Dipole Harmonic Tag for Tracking Small Animals*. The 2012 IEEE International Conference on Wireless Information Technology and Systems. Maui, HI. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

H. Aumann, E. Kus\*, B. Cline, Nuri Emanetoglu (2012). *An Asymmetrical Dipole Tag with Optimum Harmonic Conversion Efficiency*. The 2012 IEEE Antennas and Propagation Society International Symposium. Chicago, IL. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

### Inventions

Nothing to report.

### Journals

W. Duy, T. Mlsna, S. Nadeau\*, D. Neivandt, J. Vetelino (2013). *Peroxide Based Explosive Sensor using a Lateral Field Excited Bulk Acoustic Wave Sensor*. *IEEE Sensors*. N/A N/A. Status = ACCEPTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

**Licenses**

Nothing to report.

**Other Products**

Nothing to report.

**Other Publications****Patents**

Nothing to report.

**Technologies or Techniques**

Nothing to report.

**Thesis/Dissertations****Websites**

*NSF REU Site: Sensor Science and Engineering*

<http://web.eece.maine.edu/research/URP/>

This web site contains information on the REU Site at UMaine Electrical and Computer Engineering, including application details, past projects and participants.

**Participants/Organizations****Research Experience for Undergraduates (REU) funding**

Form of REU funding support: REU site award

How many REU applications were received during this reporting period? 0

How many REU applicants were selected and agreed to participate during this reporting period? 4

REU Comments: Three REU fellows from the summer of 2011 continued their projects during the academic year.

**What individuals have worked on the project?**

Name	Most Senior Project Role	Nearest Person Month Worked
Vetelino, John	PD/PI	0
Emanetoglu, Nuri	Co PD/PI	0
Fitzgerald, Michael	Research Experience for Undergraduates (REU) Participant	1

Kus, Evan	Research Experience for Undergraduates (REU) Participant	1
Muzzy, Heather	Research Experience for Undergraduates (REU) Participant	1
Nadeau, Sara	Research Experience for Undergraduates (REU) Participant	1

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**Full details of individuals who have worked on the project:**


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**John F Vetelino****Email:** vet@eece.maine.edu**Most Senior Project Role:** PD/PI**Nearest Person Month Worked:** 0**Contribution to the Project:** PI. Advised Mr. Fitzgerald, Ms. Muzzy and Ms. Nadeau.**Funding Support:** Not funded from the grant during the academic year.**International Collaboration:** No**International Travel:** No

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**Nuri Emanetoglu****Email:** nuri.emanetoglu@maine.edu**Most Senior Project Role:** Co PD/PI**Nearest Person Month Worked:** 0**Contribution to the Project:** Co-PI. Advised Mr. Evan Kus.**Funding Support:** Not funded from grant during the academic year.**International Collaboration:** No**International Travel:** No

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**Michael Fitzgerald****Email:** Michael\_Fitzgerald@umit.maine.edu**Most Senior Project Role:** Research Experience for Undergraduates (REU) Participant**Nearest Person Month Worked:** 1**Contribution to the Project:** Mr. Fitzgerald continued his research on AIN thin films for thin film resonator sensors.**Funding Support:** REU grant.**International Collaboration:** No**International Travel:** No**Year of schooling completed:** Junior**Home Institution:** University of Maine**Government fiscal year(s) was this REU participant supported:** 2011

**Evan Kus****Email:** Evan\_Kus@umit.maine.edu**Most Senior Project Role:** Research Experience for Undergraduates (REU) Participant**Nearest Person Month Worked:** 1**Contribution to the Project:** Mr. Kus continued his research on wireless tags for juvenile amphibian tracking during the academic year.**Funding Support:** REU Grant**International Collaboration:** No**International Travel:** No**Year of schooling completed:** Junior**Home Institution:** University of Maine**Government fiscal year(s) was this REU participant supported:** 2012, 2011**Heather Muzzy****Email:** heather.muzzy@umit.maine.edu**Most Senior Project Role:** Research Experience for Undergraduates (REU) Participant**Nearest Person Month Worked:** 1**Contribution to the Project:** Ms. Muzzy continued her research on a saxitoxin sensor based on LFE BAW devices.**Funding Support:** REU grant.**International Collaboration:** No**International Travel:** No**Year of schooling completed:** Junior**Home Institution:** University of Maine**Government fiscal year(s) was this REU participant supported:** 2011**Sara Nadeau****Email:** Sara\_Nadeau@umit.maine.edu**Most Senior Project Role:** Research Experience for Undergraduates (REU) Participant**Nearest Person Month Worked:** 1**Contribution to the Project:** Ms. Nadeau continued her research on LFE sensors during the academic year.**Funding Support:** REU grant**International Collaboration:** No**International Travel:** No**Year of schooling completed:** Junior**Home Institution:** University of Maine**Government fiscal year(s) was this REU participant supported:** 2011**What other organizations have been involved as partners?**

Nothing to report.

**What other collaborators or contacts have been involved?**

NO

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## Impacts

### **What is the impact on the development of the principal discipline(s) of the project?**

The passive harmonic wireless tag design was refined and optimized. Two conference papers were published in this work. New configurations for lateral field excited (LFE) sensors and AIN thin films for thin film resonator (TFR) sensors were investigated.

### **What is the impact on other disciplines?**

Researchers in Wildlife and Ecology utilized the passive harmonic wireless tags for tracking frogs. The LFE and AIN TFR projects involved physics, materials science and chemistry.

### **What is the impact on the development of human resources?**

Four REU fellows, two of them women students, continued their research from the summer of 2011, providing them with additional exposure to research methods and improving their laboratory skills.

### **What is the impact on physical resources that form infrastructure?**

Nothing to report.

### **What is the impact on institutional resources that form infrastructure?**

Nothing to report.

### **What is the impact on information resources that form infrastructure?**

Nothing to report.

### **What is the impact on technology transfer?**

Nothing to report.

### **What is the impact on society beyond science and technology?**

Nothing to report.

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## Changes/Problems

### **Changes in approach and reason for change**

Nothing to report.

### **Actual or Anticipated problems or delays and actions or plans to resolve them**

Nothing to report.

### **Changes that have a significant impact on expenditures**

Nothing to report.

### **Significant changes in use or care of human subjects**

Nothing to report.

### **Significant changes in use or care of vertebrate animals**

Nothing to report.

### **Significant changes in use or care of biohazards**

Nothing to report.

