Quarterly Progress Report:
Project Number and Title: Thrust #1 Distributed Fiber Optic Sensing System for Bridge Monitoring
Research Area: Thrust #1
PI: Xingwei Wang, Electrical and Computer Engineering Department, University of Massachusetts Lowell
Co-PI(s): TzuYang Yu, Civil Engineering Department, University of Massachusetts Lowell.
Reporting Period: *01/01/2021-03/30/2021*
Submission Date: 3*/22/2021*

Overview: (Please answer each question individually)

- Developed signal processing procedure to remove some of the random peaks that occur when BOTDA/BOTDR data is collected
- Compared data collected from different systems.

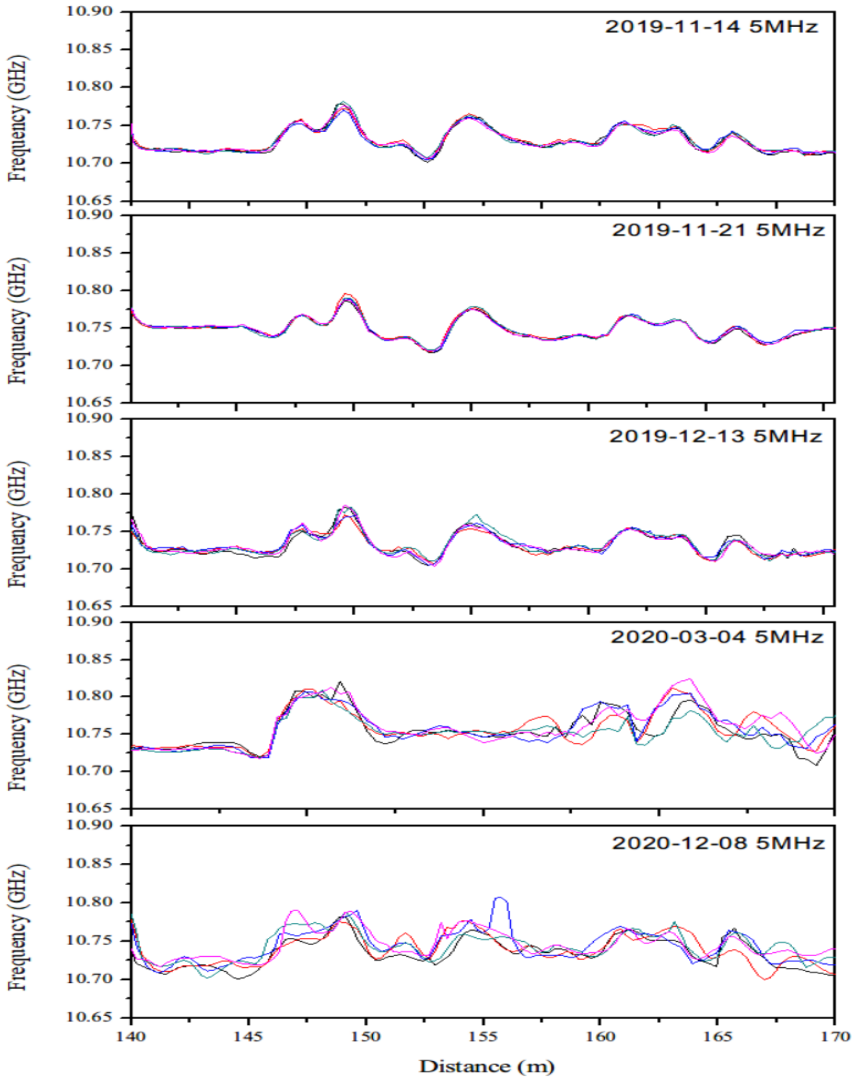

Figure 1 BOTDR baseline comparison

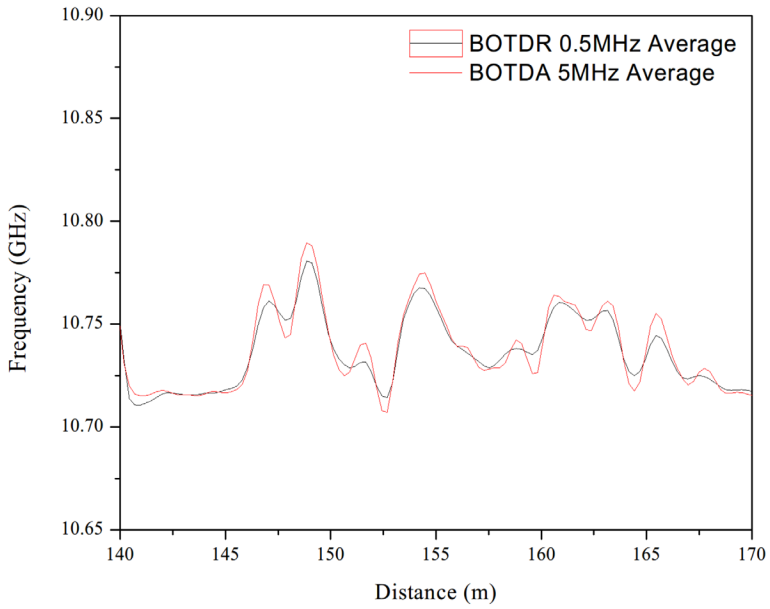

Figure 2 Comparison between BOTDA and BOTDR results.

Provide context as to how these activities are helping achieve the overarching goal(s) of the project…

The overall objective of this project is the long-term monitoring of a bridge. This includes the analysis of the data that is collected throughout the different seasons of the year. The data measured will be affected by the environmental conditions which will introduce random peaks on the measurements. Additionally, the harsh winter of New Hampshire may have some impact on the overall performance of the sensor. For this reason, the study done throughout this quarter will help to compensate and remove some of the noise introduced by the mentioned conditions as well as to understand the environmental effect on the sensor.

Describe any accomplishments achieved under the project goals…

Complete the following tables to document the work toward each task and budget (add rows/remove rows as needed, make sure you complete the Overall Project progress row, and include all tasks even if they have ended or have not been started)…

Table 1: Task Progress			
Task Number	**Start Date**	**End Date**	**% Complete**
Task 1: Sensor development	1/1/2019	6/30/2019	100%
Task 2: Signal processing and sensor characterization	1/1/2019	12/30/2019	100%
Task 3: Preliminary field test on the bridge	6/1/2029	12/30/2020	90%
Overall Project:	1/1/2019	12/30/2020	90%

Table 2: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date***
$125k	$100k	80%

Include the date the budget is current.

We maintained constant communication with the technical team from OMNISENS and LUNA Innovation. They are continuously providing insight on how to use the BOTDA/BOTDA and OFDR controllers. Additionally, we have attended a different webinar sponsored by the Fiber Optic Sensing Association (FOSA) where they discussed current technology and approaches in the area of Distributed Fiber Optic Sensors.

Describe any activities involving the dissemination of research results (be sure to include outputs, outcomes, and how the outcomes/outputs have had an impact during the reporting period. Please use the tables below for any Publications and Presentations in addition to the description of any other technology transfer efforts that took place during the reporting period.)… Use the tables below to complete information about conferences, workshops, publications, etc. ***List all other outputs, outcomes, and impacts after the tables*** *(i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings).*

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events

Title	Event	Type	Location	Date(s)
Optical Fiber Sensing textile for Temperature and Distributed Measurment	Smart structure + Nondestructive evaluation.	(SPIE)Conference	Online	03/22/21-03/26/21

Table 4: Publications and Submitted Papers and Reports

Type	Title	Citation	Date	Status
Conference	Optical Fiber Sensing textile for Temperature and Distributed Measurement			Accepted by the conference
Journal	Pipeline monitoring using fiber optic textile for Structural Health Monitoring			Updating draft with comments provided by the coauthors

Encouraged to add figures that may be useful (especially for the website)…

Insert figures here

Participants and Collaborators:

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members

Individual Name	Email Address	Department	Role in Research
Xingwei Wang	Xingwei_wang@uml.edu	Electrical and Computer Engineering	PI
TzuYang Yu	Tzuyang_yu@uml.edu	Civil Engineering	Co-PI

Use the table below to list all students who have participated in the project during the reporting. (This includes all paid, unpaid, intern, independent study, or any other student that participated in this project.)

Table 6: Student Participants during the reporting period				
Student Name	**Email Address**	**Class**	**Major**	**Role in research**
Andres Biondi	Ph.D.		ECE	Signal analysis
Rui Wu		Ph.D.	ECE	Signal analysis
Lidan Cao		Ph.D.	ECE	Signal analysis

Table 7: Student Graduates			
Student Name	**Role in Research**	**Degree**	**Graduation Date**

Use the table below to list organizations that have been involved as partners on this project and their contribution to the project.

Table 8: Research Project Collaborators during the reporting period						
Organization	**Location**	**Contribution to the Project**				
		Financial Support	**In-Kind Support**	**Facilities**	**Collaborative Research**	**Personnel Exchanges**
Luna Innovation	Virginia		X ($5K)			
Omnisens	Switzerland		X			

List all other outputs, outcomes, and impacts here (i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings). Please be sure to provide detailed information about each item as with the tables above.

Have other collaborators or contacts been involved? If so, who and how? (This would include collaborations with others within the lead or partner universities; especially interdepartmental or interdisciplinary collaborations.)

Table 9: Other Collaborators			
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Contribution to Research**
			(i.e. Technical Champion)

Number of active industrial partners involved in this research project

- 1 Saint Gobain

We conduct weekly meetings to discuss the project progress. UML Ph.D. student, Andres Biondi, went to Saint Gobain from time to time to work with their engineers on sensing textile testing.

- LUNA
- Craig Stratton. Luna Innovation has provided an in-kind extension module to be used with the OFDR controller.
- The senor has been deployed on a railway bridge in New Hampshire.

The number of active State DOT partners involved in the research project.

- NH DOT, we are working with NH DOT to arrange a presentation and discuss more field test plans.

Number of technical Champions actively involved in this project

1

Craig Stratton

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Changes: No cost extension has been requested. The project will end in 9/30/2021.

Planned Activities:

We will continue the long-term monitoring of the bridge in NH using the installed sensing system. In addition, we will continue to process the data to better understand the relation between the signals and the bridge health conditions.