



DOT PHMSA Quarterly Report – Public Page

Date of Report: 2nd Quarterly Report - January 1 through March 31, 2020

Contract Number: 693JK31910007

Prepared for: USDOT PHMSA and Operations Technology Develop LLC (OTD)

Project Title: Develop and Demonstrate a Remote Multi-Sensor Platform for Right-of-Way Defense

Prepared by: Gas Technology Institute

Contact Information: Mike Adamo, 847-454-3428, madamo@gti.energy

For quarterly period ending: March 31, 2020

1: Items Completed During this Quarterly Period:

Figure 1. Payable Milestones Completed this Quarter

Technical and Deliverable Milestone Schedule						
Item #	Task #	Activity/Deliverable	Title	Federal Cost	Cost Share	Total
1	1	List of members for a technical advisory panel (TAP) consisting of utilities and technology providers, presentation on the current ROW Defense technology status, and proposed improvements. Summary of feedback from the TAP members on the status of the ROW Defense System. Determine the utilities' level of interest in hosting demonstration test sites.	Technology Review	7,407.00	6,890.00	14,297.00
2	7	Submit 2 nd quarterly report	2 nd Quarterly Status Report	3,970.00	3,693.00	7,663.00
		First Payable Milestone	SUBTOTAL	11,377.00	10,583.00	21,960.00

This table was populated with Items from Attachment #3, Technical and Deliverable Payable Milestone Schedule (in the contract) that were completed during this reporting period and are the corresponding Items included on our next invoice.

2: Items Not-Completed During this Quarterly Period:

This project is currently behind schedule. The OTD co-funding contract was finalized during December of 2019. Given the requirement to coordinate the PHMSA and OTD budgets, very little effort was expended during the first project quarter. The kick-off calls with both organizations have been completed. The TAP meeting has been held and some feedback from the utilities has been captured.

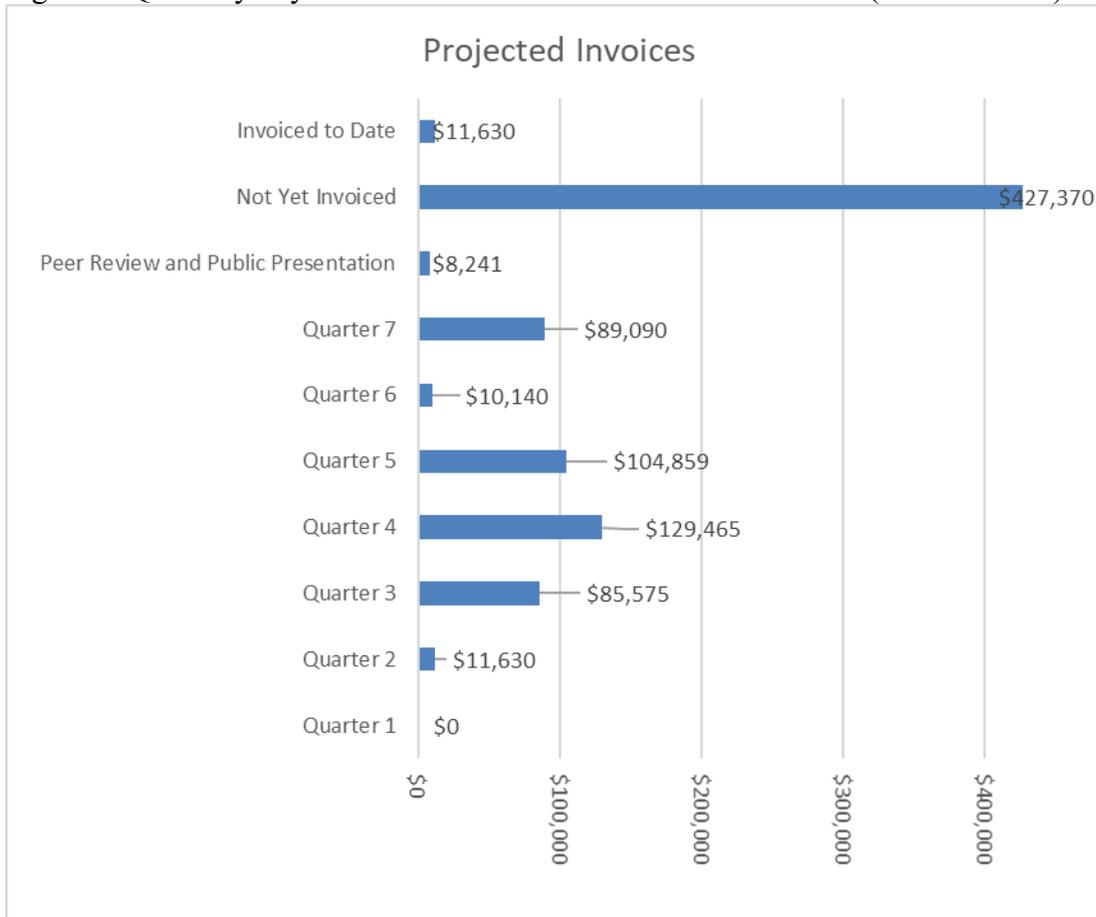
Figure 2. Payable Milestones Not Completed this Quarter

Technical and Deliverable Milestone Schedule						
Item #	Task #	Title	Activity/Deliverable	Federal Cost	Cost Share	Total
3	1	Technology Review	Provide a final list of features of and improvements to the ROW Defense technology that will be adhered to for the balance of the project. Provide a list of potential utility test sites. Provided within a quarterly report.	4,444.00	4,134.00	8,578.00
4	2	Hardware Improvements	A set of hardware requirements that incorporate the TAP feedback captured during Task 1. Provided within a quarterly report.	17,126.00	26,897.00	44,023.00
5	3	Data Management and Analytics	Review Open Geospatial Consortium (OGC) standards for representing sensor data, review current state of available Geographic Information System (GIS) tools, and create a list of the specific tools to be used in this project. Provided within a quarterly report.	47,939.00	22,806.00	70,745.00
6	4	User Interface Improvements	A set of user interface requirements that incorporate the TAP feedback captured during Task 1. Provided within a quarterly report.	12,096.00	15,291.00	27,387.00

3: Project Financial Tracking During this Quarterly Period:

The nature of the contract for this research effort is fixed price, with clearly defined milestone/deliverable payments. **Figure 2** below outlines projected invoicing, as well the invoice submitted upon delivery of the first payable milestone.

Figure 2. Quarterly Payable Milestones/Invoices - 693JK31910007 (Federal Costs)



4: Project Technical Status

ACTIVITY: TECHNOLOGY REVIEW AND TECHNICAL ADVISORY PANEL (TAP)

Item Title: Notes of Kickoff Meeting Detailing any Project Scope Changes

Item Number: 1

Task Number: 1

The project kick-off meeting was held with GTI and DOT/PHMSA January 16, 2020. The participants included: Michael Adamo/GTI, Matt Manning/GTI, Chris Ziolkowski/GTI, Rob Marros/GTI, and Chris Hoidal/DOT PHMSA.

The kick-off meeting materials and resulting meeting notes are shown below.

CONFERENCE CALL/KICK-OFF MEETING

Thursday January 16, 2020

9:00 AM CENTRAL

MS Teams Call-In Number

Dial-in Number: (312) 667-7145 / Conference ID: 582 572 071#

Agreement No.: 693JK31910007POTA

Develop and Demonstrate a Remote Multi-Sensor Platform for Right of Way Defense

OTD Team Project Manager: Mike Adamo

GTI Team Technical Coordinator: Matt Manning

GTI Project Team: Chris Ziolkowski, Rob Marros

Project Partner: Trilliant

Agenda Items (detailed call slides attached in Appendix A)

- Project Administration and Management
- Objectives and Value of Project
- Scope Summary
- Tasks
- Deliverables
- Discussion

Attendees

Chris Hoidal, PHMSA

Mike Adamo, OTD

Matt Manning, GTI

Chris Ziolkowski, GTI

Rob Marros, GTI

Goals and Objectives

- The goals and objectives of the project were discussed as well as related background information.
 - The first goal is to build on the experience from the prototype deployment by defining and planning needed improvements and capturing industry feedback.
 - The second goal is to construct and test improved ROW monitors both in a sandbox environment and at the current prototype site.

- The third goal is to deploy two new instances of the ROW monitor system by securing appropriate test sites from supporting utilities.

Task 1 – Technology Review

- The technical advisory panel (TAP) will consist of OTD members (LDCs), technology providers, GTI SMEs, and PHMSA SMEs
- The TAP will provide direct feedback on the existing prototype system and proposed hardware and user interface improvements

Task 2 – Improvements to the Hardware

- Identify opportunities to reduce prototype size, power consumption, and field harden the unit
- Simplify sensor support electronics and improve data gathering capabilities

Task 3 – Data Management and Analytics

- Review Open Geospatial Consortium standards
- Integrate event recognition and characterization techniques

Task 4 – Improvements to the User Interface

- Upgrade Operator alert functions
- Incorporate ability to add additional layers for analysis
- Enhance construction vehicle mobile data capture

Task 5 – Deployment and Testing of Improved System

- Looking to incorporate a minimum of two additional test sites in addition to existing prototype location
- Ideally sites operational for 6-12 months

Discussion

- Question: Is the system being tested on steel pipe only?
 - Answer: This project will only cover steel pipe. The system might be extendable to PE but would require modification of the sensors beyond the current scope of work.
- Question: What sensors are currently incorporated into the system?
 - Answer: The present sensors include vibration on the pipe and adjacent soil, strain capturing the longitudinal strain on the pipe, current capturing the electrical current density – both DC and AC, seismic, and soil capturing conductivity and temperature.
- Question: Is the team considering adding additional types of sensors, like methane for example?
 - Answer: The team is open to considering adding new sensors to the prototype system. This should be discussed as a requirement at the TAP meeting.

Action Items

1. **(GTI)** Form a TAP from Sponsor SMEs
2. **(GTI)** Schedule a TAP detailed technical review meeting in the 2nd-half of February
3. **(GTI)** Define review period to finalize improvements and requirements
4. **(GTI)** Identify date to generate list of potential test sites

Develop and Demonstrate a Remote Multi-Sensor Platform for Right of Way Defense

DOT PHMSA Kickoff Meeting

Michael Adamo, Operations Technology Development
 Agreement #693JK31910007POTA
 Date: January 2020

Project Team

- Project Manager: Mike Adamo, OTD
- Team Technical Coordinator: Matt Manning
- GTI Project Team: Chris Ziolkowski, Rob Marros
- Project Partner: Trilliant

Project at a Glance

<p>Objective</p> <p>The objective is to improve and deploy additional instances of a defensive pipeline right-of-way (ROW) Monitoring System based on stationary sensors mounted on and near the pipeline. Sensor data from multiple locations along the pipe is wirelessly forwarded to a central location for processing. Analytics at the central location correlates data from multiple sensors to rapidly alert operators to events occurring in the ROW.</p>	<p>Opportunity Statement</p> <p>Activity (such as excavation) in the pipeline ROW can have unplanned consequences, including damage causing gas leakage, greenhouse gas emissions, and disruption of energy delivery. In extreme cases, fire or explosion may result. Methods to monitor the entire ROW, such as distributed fiber optic sensors, are difficult to install on pipelines in populous areas. Real-time monitoring will provide better situational awareness than patrols or other current practices.</p>																																																																														
<p>Project Scope</p> <p>Task 1 = Technology Review Task 2 = Hardware Improvements Task 3 = Data Management and Analytics Task 4 = Improvements to User Interface Task 5 = Deployment of System Task 6 = Project Management</p>	<p>Project Budget Information</p> <table border="1"> <thead> <tr> <th>Cost Category</th> <th>Cost</th> </tr> </thead> <tbody> <tr> <td>In Kind Cost Share - Trilliant</td> <td>\$31,000</td> </tr> <tr> <td>Cash Cost Share - OTD</td> <td>\$408,000</td> </tr> <tr> <td>Amount Requested from DOT PHMSA</td> <td>\$439,000</td> </tr> <tr> <td>Total Program Cost</td> <td>\$878,000</td> </tr> </tbody> </table>	Cost Category	Cost	In Kind Cost Share - Trilliant	\$31,000	Cash Cost Share - OTD	\$408,000	Amount Requested from DOT PHMSA	\$439,000	Total Program Cost	\$878,000																																																																				
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Background

- Several high-profile incidents have elevated the importance of risk management.
- Risks must be recognized and measured to avoid incidents.
- Risk mitigation has become increasingly data-driven.
- Measurement technology based on ubiquitous communication and low-cost sensors can fill this need.

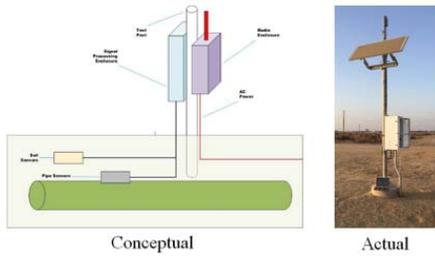


Source: <https://gigaopportunity.com/news/energy-safety-obs-activation-guide/>

Source: <https://mhfiare-1.innov.org/5-evaluation-guidelines-and-templates/>

Overall goal of project

- The overall goal is to improve on a prototype of a right-of-way (ROW) monitoring system and to deploy it in additional locations.



Source: <https://www.analytics.com/resources/2015-detecting-pipeline-right-of-way-encroachments-using-satellite-data-vehicles-heavy-machinery-on-construction-and-other-human-caused-changes/>

Specific Goals and Objectives

- Build on the experience from the prototype deployment
 - Define and plan needed improvements
 - Capture industry feedback on these plans
- Construct and test improved ROW monitors
 - Test in sandbox environment
 - Rollout and test at current prototype site
- Deploy two new instances of the ROW monitor system
 - Secure appropriate test sites from supporting utilities
 - Deploy, monitor, and report on new systems

Task 1 – Technology Review

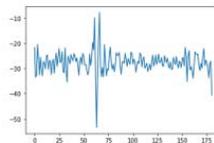
- Provide stakeholders a review that:
 - Describes the current technology state
 - Outlines the proposed path forward
- Establish a Technical Advisory Panel (TAP) of:
 - OTD members (LDCs)
 - Technology providers
- The TAP will provide direct feedback on the existing prototype system and proposed hardware and user interface improvements



Source: <https://www.womenspreventionhealth.org/about-us/structure/>

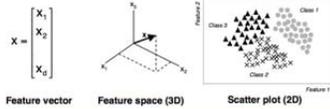
Task 2 – Improvements to the Hardware

- Address prototype system implementation details
 - Reduce prototype size
 - Lower power consumption
 - Field harden unit
- Modify on-pipe vibration sensors
 - Streamline sensor to pipe application methods
 - Simplify/optimize sensor support electronics
- Improved data gathering capabilities
 - Identify smaller, less expensive end point radios and data logger options



Task 3 – Data Management and Analytics

- Review Open Geospatial Consortium standards and GIS tools
- Integrate machine learning techniques for event recognition/characterization
- Advance necessary architectures for short- and long-term storage capabilities



Task 4 – Improvements to the User Interface (UI)

- Advance prototype UI to:
 - Upgrade operator alert functions
 - Add insert/review additional data layers abilities
 - Enhance construction vehicle mobile data capture
- Leverage live data from Task 2 to test UI improvements
- Demonstrate updates to TAP for approval prior to Deployment Task



Task 5 – Deployment & Testing of Improved System

- Deploy improved ROW defense system
 - A minimum of 2 more test sites needed
 - Prototype site is in a desert environment
 - Want environmental diversity
- Hosting utilities to receive system training
- Test site operated for 6 – 12 months



Milestones and Deliverables

Activity	Completion Date	Milestone/Deliverable
Task 1 – Technical Review	3 months	Kick-off meeting notes and TAP members list
Task 2 – Hardware Improvements	6 months	Prototype and sensors improvements; improved data gathering
Task 3 – Data Management and Analytics	21 months	OGC standards review; machine learning for event recognition
Task 4 – User Interface Improvements	15 months	Upgraded UI; TAP demonstration using live data
Task 5 – Deploy System	21 months	Improved system deployment at minimum 2 sites for 6 – 12 month duration
Task 6 – Project Management	24 months	Ongoing: Monthly Updates, Quarterly Reports, Project Final Presentation

ACTIVITY: SUBMIT 1ST QUARTERLY STATUS REPORT

Item Title: 1st Quarterly Report

Item Number: 2

Task Number: 6

This item was completed on December 31, 2019.

ACTIVITY: TECHNOLOGY REVIEW TAP FEEDBACK

Item Title: Capture TAP Feedback

Item Number: 3

Task Number: 1

This item was partially completed.

The list of features of and improvements to the ROW Defense technology were presented to the TAP members. Some feedback as to additional features was received. The requirements that will be adhered to for the balance of the project are still being developed. Potential utility test sites are still being solicited. SoCal Gas and Ameren have both expressed interest in hosting sites. One more utility is being sought.

ACTIVITY: HARDWARE IMPROVEMENTS

Item Title: Develop Hardware Requirements

Item Number: 4

Task Number: 2

This item is not complete.

A set of hardware requirements that incorporate the TAP feedback captured during Task 1. Provided within a quarterly report.

ACTIVITY: DATA MANAGEMENT AND ANALYTICS

Item Title: Review of GIS Standards and Tools

Item Number: 5

Task Number: 3

This item is not complete.

Review Open Geospatial Consortium (OGC) standards for representing sensor data, review current state of available Geographic Information System (GIS) tools, and create a list of the specific tools to be used in this project. Provided within a quarterly report.

ACTIVITY: USER INTERFACE REQUIREMENTS

Item Title: Capture TAP feedback

Item Number: 6

Task Number: 4

This item is not complete.

A set of user interface requirements that incorporate the TAP feedback captured during Task 1. Provided within a quarterly report.

ACTIVITY: SUBMIT 2ND QUARTERLY STATUS REPORT

Item Title: 2nd Quarterly Report

Item Number: 7

Task Number: 6

This document is the completed, current quarterly report.

ACTIVITY: PROJECT MANAGEMENT

Item Title: N/A

Item Number: N/A

Task Number: 6

During this quarter, GTI conducted project scheduling, budgeting, task/activity sequencing, preparation of reports, and coordination, organization, and facilitation of required meetings.

5: Project Schedule

The project schedule through September 30, 2021 is shown below. The project is 3 months behind schedule. Progress on payable milestones (delineated by Item and Task number) are linked to the schedule and are also shown below for completeness.

Figure 3. Project Schedule

Task	Item	Title	% Complete	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1	1	Technology Review TAP	100%	■							
1	3	Technology Review Report	100%		■						
2	4	Hardware Improvements Requirements	50%		■						
2	8	Hardware Improvements Identify Products	10%			■					
2	12	Hardware Improvements Procurement	0%				■				
2	17	Hardware Improvements Testing	0%					■			
3	5	Data Management/Analytics Review	0%		■						
3	9	Data Management set up GIS	0%			■					
3	13	Data Management Machine Learning	0%				■				
3	18	Data Management Initial Performance	0%					■			
3	24	Data Management Final Performance	0%							■	
4	6	User Interface Improvements Requirements	0%		■						
4	10	User Interface Initial Demonstration	0%			■					
4	14	User Interface Verify GIS Connection	0%				■				
4	19	User Interface Final Demonstration	0%					■			
5	15	Deployment of System Confirm Test Sites	0%				■				
5	20	Deployment Installation Report	0%					■			
5	22	Deployment First Operation Report	0%						■		
5	25	Deployment Second Operation Report	0%							■	
6		Project Management	12%	■	■	■	■	■	■	■	■
				2019	2020				2021		

Figure 4. Item Progress

Technical and Deliverable Milestone Schedule						
Item No.	Task No. (per proposal)	Activity/Deliverable	Quarter No.	Expected Completion Date/Mos	Payable Milestone	Item Progress
1	1	Technology Review	1	3 months	List of members for a technical advisory panel (TAP) consisting of utilities and technology providers, presentation on the current ROW Defense technology status, and the proposed improvements. Summary of feedback from the TAP members on the status of the ROW Defense System. Determine the utilities' level of interest in hosting demonstration test sites. Provided within a quarterly report.	Complete
2	6	1st Quarterly Status Report	1	3 months	Submit 1st quarterly report	Complete
First Payable Milestone			1	3 months	SUBTOTAL	Complete
3	1	Technology Review	2	6 months	Provide a final list of features of and improvements to the ROW Defense technology that will be adhered to for the balance of the project. Provide a list of potential utility test sites. Provided within a quarterly report.	Not Complete
4	2	Hardware Improvements	2	6 months	A set of hardware requirements that incorporate the TAP feedback captured during Task 1. Provided within a quarterly report.	Not Complete
5	3	Data Management and Analytics	2	6 months	Review Open Geospatial Consortium (OGC) standards for representing sensor data, review current state of available Geographic Information System (GIS) tools, and create a list of the specific tools to be used in this project. Provided within a quarterly report.	Not Complete
6	4	User Interface Improvements	2	6 months	A set of user interface requirements that incorporate the TAP feedback captured during Task 1. Provided within a quarterly report.	Not Complete
7	6	2nd Quarterly Status Report	2	6 months	Submit 2nd quarterly report	Complete
Second Payable Milestone			2	6 months	SUBTOTAL	Not Complete
8	2	Hardware Improvements	3	9 months	Identify alternative hardware products that can reduce the size and power consumption of the ROW Defense System. Provide a list of the selected devices. Verify costs and delivery times. Provided within a quarterly report.	On Schedule
9	3	Data Management and Analytics	3	9 months	Set up and maintain for the duration of the project a GIS environment to capture and visualize data collected from the various test sites. Provide the test site hosts and other stakeholders login credentials. Provide basic training on usage.	On Schedule
10	4	User Interface Improvements	3	9 months	Provide a demonstration of improved ability of the dashboard to drill down to details and to present warnings and alerts.	On Schedule
11	6	3rd Quarterly Status Report	3	9 months	Submit 3rd quarterly report	On Schedule
Third Payable Milestone			3	9 months	SUBTOTAL	
12	2	Hardware Improvements	4	12 months	Procure equipment to facilitate hardware improvements and test improvements on pipe in GTI or utility test yard. Create a test report showing the performance of the equipment. Provided within a quarterly report	On Schedule
13	3	Data Management and Analytics	4	12 months	Investigate machine learning (ML) tools available for the selected GIS environment. Provide an assessment of their applicability to the expected test site data. Provided within a quarterly report	On Schedule
14	4	User Interface Improvements	4	12 months	Provide test data verifying that improved hardware can connect to GIS and to dashboard. Provided within a quarterly report.	On Schedule
15	5	Deploy System	4	12 months	Complete procedures and equipment list required to deploy the ROW Defense System on a test site. Finalized location of utility test sites. Schedule for deployment of equipment on test sites. Provided within a quarterly report	On Schedule
16	6	4th Quarterly Status Report	4	12 months	Submit 4th quarterly report	On Schedule
Fourth Payable Milestone			4	12 months	SUBTOTAL	
17	2	Hardware Improvements	5	15 months	Provide final test reports or needed clarifications showing the performance of the equipment as deployed. Provided within a quarterly report.	On Schedule
18	3	Data Management and Analytics	5	15 months	Summarize the performance and costs of maintaining GIS environment. Provided within a quarterly report	On Schedule
19	4	User Interface Improvements	5	15 months	Provide second and final demonstration of improved dashboard to TAP	On Schedule
20	5	Deploy System	5	15 months	Narrative describing the deployment of equipment on the utility test sites. The narrative will cover the installation process and any issues encountered. Provided within a quarterly report.	On Schedule
21	6	5th Quarterly Status Report	5	15 months	Submit 5th quarterly report	On Schedule
Fifth Payable Milestone			5	15 months	SUBTOTAL	
22	5	Deploy System	6	17 months	Narrative describing the operation of equipment on the utility test sites. The narrative will cover events observed or recorded on the test sites during the reporting period. Provided within a quarterly report	On Schedule
23	6	6th Quarterly Status Report	6	18 months	Submit 6th quarterly report	On Schedule
Sixth Payable Milestone			6	18 months	SUBTOTAL	
24	3	Data Management and Analytics	7	21 months	Final summary of the performance of GIS ML tools on data from the utility test sites. Provided within a quarterly report.	On Schedule
25	5	Deploy System	7	21 months	Narrative describing the operation of equipment on the utility test sites. The narrative will cover events observed or recorded on the test sites during the reporting period. Provided within a quarterly report	On Schedule
26	6	7th Quarterly Status Report	7	21 months	Submit 7th quarterly report	On Schedule
Seventh Payable Milestone			7	21 months	SUBTOTAL	
27	6	8th Quarterly Status Report	8	24 months	Combine with Draft Final Report	On Schedule