External Quarterly Report

Date of Report: 2nd Quarterly Report -March 30th, 2024

Contract Number: 693JK32310012POTA

Prepared for: DOT PHMSA

Project Title: A Framework for Improving Geohazard Monitoring, Data Integration, and Information Fusion at Scale

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For quarterly period ending: March 30th, 2024.

1: Items Completed During this Quarterly Period:

Item #	*Task #*	*Activity/Deliverable*	*Title*	*Federal Cost*	*Cost Share*
3	1	Project Kickoff, Stakeholder Identification, Requirements Development, and State-of-the-Art Documentation	Inventory and gap analysis of existing data schemas and standards	$22,268	$16,222
** 4*	*4*	*Standards Organization Outreach*	*Interim Report 1 on standards organization outreach*	-	-
5	11	1st Quarterly Status Report	Submit 1st quarterly report	$2,212	$1,364

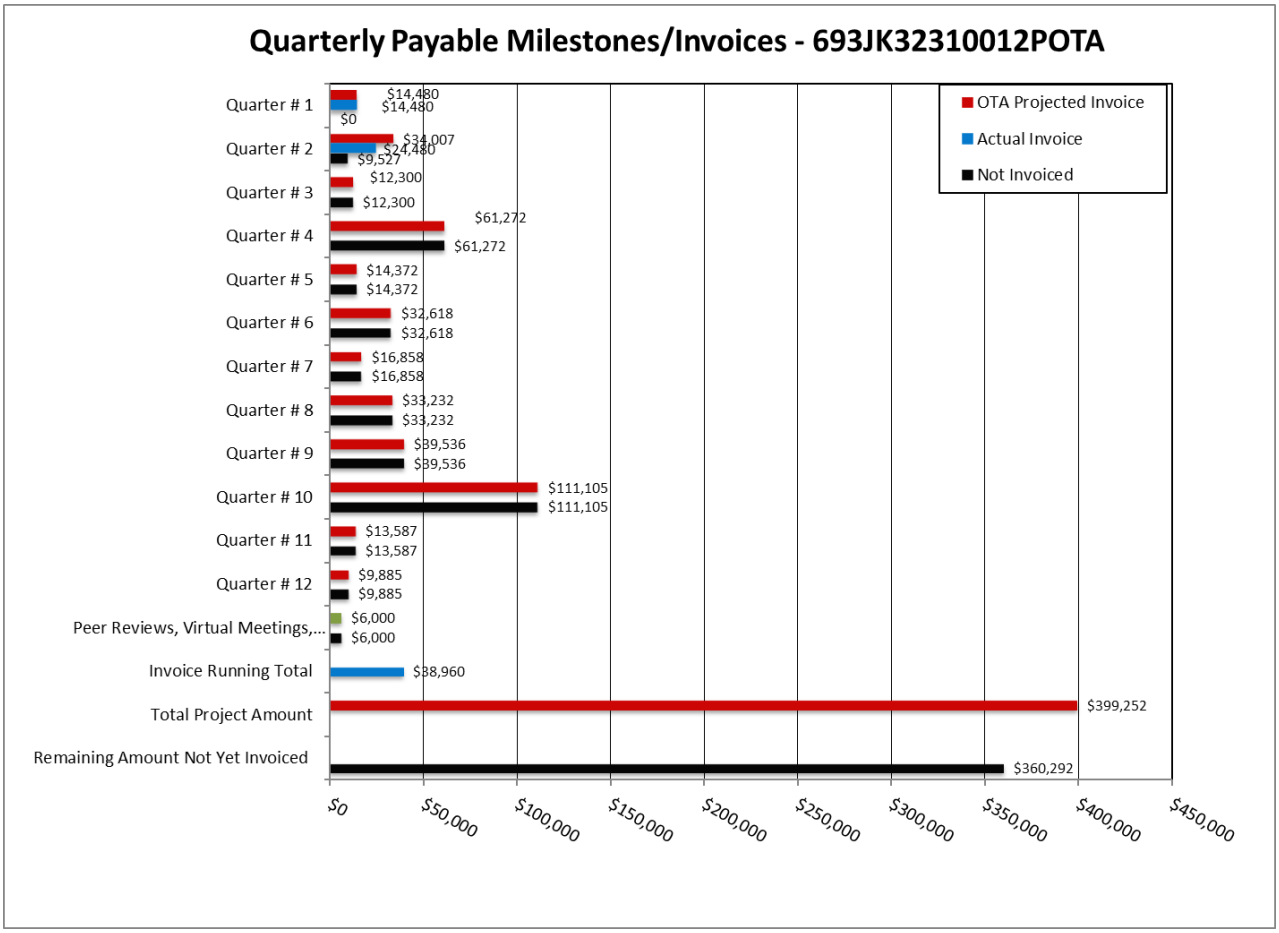
** Items in blue italic font were not completed as planned.*

1. Item #3 Convene Technical Advisory Panel (TAP) and conduct kick-off Team meeting.
2. Item #5: Submit 1st quarterly report.

2: Items Not Completed During this Quarterly Period:

1. Item #3 Interim Report 1 on standards organization outreach.

3: Project Financial Tracking During this Quarterly Period:



4: Project Technical Status

1. The inventory and gap analysis of existing data schemas and standards was completed as planned and is presented in Appendix1.
   Understanding and getting ahead geohazard risk to pipelines across changing landscapes and through time presents specific challenges around data collection, data management and data integration.

   Monitoring and tracking the impact of geohazards on infrastructure requires inferring the state of the world in the context of complex, dynamic systems that are in constant flux. Operators cannot afford to measure everything they need to know, yet are required to plan, predict and mitigate hazardous events before they occur. This requires analysts and data scientists to fuse information, observations, and data to infer the state of the world near their assets.

   Current approaches to information fusion rely on disjointed workflows that are not scalable and not automated. One-off geo-joins are not reusable between models, between modelers, across software frameworks, or between companies. This slows velocity and stifles progress as efforts are duplicated and time is lost in on manual, isolated, computationally expensive, and disjointed workflows.

   This is an even greater challenge when the majority of data needed as inputs has no address to begin with and has amorphous boundaries that shift over time.

   Monitoring infrastructure and predicting risk requires a particular scale of compute infrastructure that is not easily accessible to analysts today. The scale of computations needed requires optimized data storage and engineering, with special considerations given to speed and efficiency.

   Consequently, technological barriers to large-scale compute and efficient data management block viable pathways to scale efficiently towards sensor fusion, automation, and on a broader level information fusion across multiple scales and resolutions. Finally, these technological barriers stifle the ability to blend modeling approaches together, such as physics simulations and machine learning, with spatial/temporal approaches.

   This paper proposes a practical way to organize information that tackles the technological barriers that impede the large-scale analysis, modeling, and predictions required to understand geohazard risk to oil and gas pipelines. We propose an efficient way to index and address observations spatially and temporally, rendering data analysis–ready and optimized for easy access and compute; geohashing. Driving this approach is the strategy that by making data analysis-ready, addressable, and accessible to networks of models, there are significant payoffs that enable more dynamic and complex analysis at scale.

This addressing system and software technology will accelerate large queries, support automation and real-time analysis, and remove inefficiencies baked into traditional ways of addressing these problems.

2. The standards outreach effort has not yet begun due to unforeseen contracting delays due to backlog in the GTI Energy contracting pipeline. This subcontract is close to resolution, and we anticipate that the first interim report on standards organization outreach will be delivered in the upcoming Q3 quarterly report.

End of report