Quarterly Report – Public Page

Date of Report: 5*th Quarterly Report – November 8, 2019*

Contract Number: *693JK31810002*

Prepared for: *DOT*

Project Title: *On-Board Power and Thrust Generation for the Explorer Family of Robots for the Inspection of Unpiggable Natural Gas Pipelines*

Prepared by: *Northeast Gas Association*

Contact Information: *Daphne D'Zurko; 973-265-1900, ext. 214; ddzurko@northeastgas.org*

For quarterly period ending: *October 31, 2019*

1: Items Completed During this Quarterly Period:

During this 5th Quarter the following tasks were completed.

Item #	***Task #***	***Activity/Deliverable***	***Title***	***Federal Cost***	***Cost Share***
22	1.3-C	Complete testing of energy harvesting module in the laboratory	Module laboratory testing	$27,150	$27,150
23	1.4-A	Refine design based on testing results	Module refinement	$39,550	$39,550
24	2-E	Technical management of project	Consultant	$5,040	$5,040
25	3-E	Submit 5th quarterly report	NYSEARCH project management	$6,054	$6,021
27	1.4-B	Completed refined design based on testing results	Module refinement	$16,950	$16,950
28	1.5-A	Building of testing platform for Explorer	Testing platform integration	$33,250	$33,250
29	1.6-A	Planning for testing system in the field	Filed testing	$43,750	$43,750
33	1.5-B	Build testing platform for field testing purposes	Testing platform integration	$14,250	$14,250

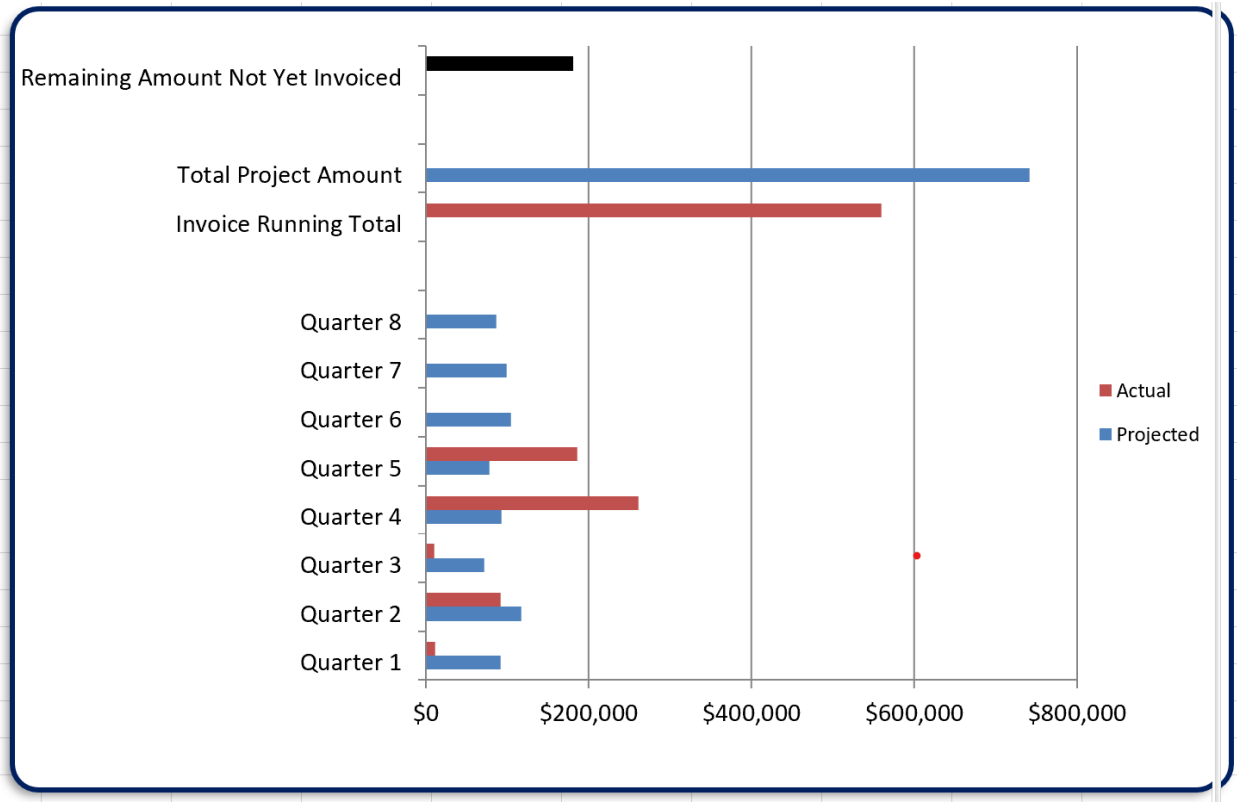
As seen the project is ahead of schedule.

2: Items Not-Completed During this Quarterly Period:

The project is ahead of schedule.

3: Project Financial Tracking During this Quarterly Period:

QUARTERLY PAYABLE MILESTONES/INVOICES - 693JK31810002



4: Project Technical Status –

Task 1.3-C: *Module Laboratory Testing*

As reported in the previous quarter, once assembly was completed, with all subsystems tested for integrity and functionality, testing of the entire module as a unit was initiated to establish the performance characteristic of the actual system and compare it to the design targets. Such testing continued and was completed during this quarter utilizing the testing loop (see Figure 1) that was built for this purpose in the laboratory. A number of issues emerged during testing that resulted in mostly minor design changes to address them.

Task 1.4-A & B: *Module Refinement*

Following the testing of the module for functionality, testing was initiated to determine ways to improve its performance for maximum efficiency and output. The effort was concentrated on two fronts; dealing with the technical issues identified during earlier tasks and implementing module control via the main GUI of the platform (instead of the software build and used during the early stages of testing that resided on the laptop used to carry out the lab testing).

Task 1.5-A & B: Testing Platform Integration

The module was next integrated on the testing platform (a version of the Explorer 20/26 robot dedicated to testing purposes). The communication of the module with the rest of the robot was tested to ensure proper exchange of information and proper response of the energy harvesting module to control commands send from the main computer and the operator. The system was then run in the testing loop to verify performance. In preparation for the live field test, the testing robot with the energy harvesting module integrated on it was also successfully tested for launch and retrieval.

Task 1.6-A: Field Testing

The objective of the field test is to verify proper system operation under live conditions, and how much energy can be harvested from the pipeline flow and made available to the Explorer robot to extend its range. The field test effort involves the following activities:

- Identify proper site and work with hosting utility to prepare and execute the field testing plan
- Prepare and deploy the Explorer 20/26-based Testing Platform, equipped with the energy harvesting module and the testing system, on a live pipeline where pipeline flow rates can be varied and metered.
- Establish baseline operating conditions for the test setup using varying flow conditions
- Engage the energy harvesting module and measure the performance of the robot (test platform) under varying flow conditions (if flow variability is allowed by the host utility)
- Determine the effects of the energy harvesting module on robot operational parameters such as overall range and gains in operational efficiencies.

After completion of the field test the system will be inspected and the collected data will be reviewed. Any findings will be applied to the Explorer robot and energy harvesting module in the final task; integration on Explorer.

The planning of the field trial of the system was carried out during this period. A NYSEARCH member company and sponsor of this project volunteered to host the field trial. It is scheduled for mid-November 2019. In strong cooperation with the company's

engineers, the field trial has been planned in all its details and will be carried out, unless forces outside this project necessitate otherwise.

5: Project Schedule –

The project is ahead of schedule.