

Rapid Aerial Small Methane Leak Survey (RASMLS), 1st Quarterly Report: Public Version

December 28, 2015

Date of Report: *1st Quarterly Report-December 28, 2015*

Contract Number: *DTPH5615T00016*

Prepared for: *DOT, PHMSA*

Project Title: *Rapid Aerial Small Methane Leak Survey*

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For quarterly period ending: *December 31, 2015*

1.0 Funds and Work Completed During this Quarterly Period:

The first quarter of the Rapid Aerial Small Methane Leak Survey (RASMLS) project included the kick-off and Technical Advisory Committee meeting (Task 1) and much work on the Early Flight Demonstration (Task T2). **Figure 1-1** shows the value of milestones achieved vs. the value of the milestones planned for the first quarter.

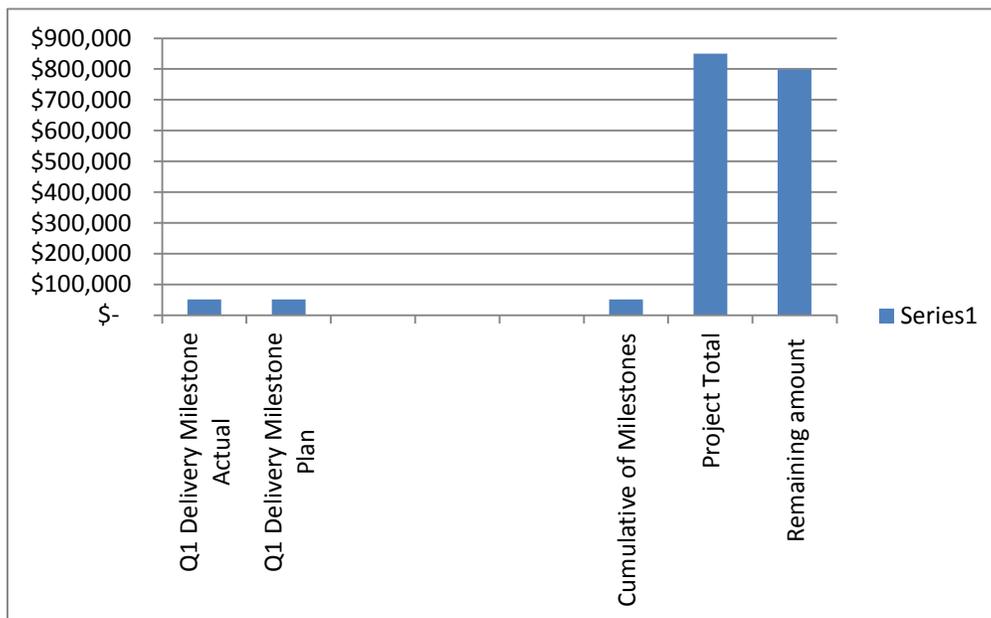


Figure 1, The RASMLS project is completing its delivery milestones on-schedule and adhering to the funding plan set-forth in the proposal and resulting Agreement.

1.1 Technical Status and Progress

Delivery Milestone D1, Task T0, Technical and Project Management: This task consists of a level-of-effort for project system engineering, project management and business administration. The key accomplishments of the 1st Quarter were to organize and host the Kick-Off and Technical Advisory Committee meeting which was held on November 9th, 2015.

A copy of the DIAL Instrument Performance Model (IPM) is being used to explore the overall performance of the push-broom sensor configuration for RASMLS and the characteristics of key components (linear array detector and lasers) are being studied in detail. Note that the IPM is a valuable tool to support design and analysis of the RASMLS DIAL instrument and was contributed by Ball as it was previously developed with internal R&D funding.

Technical and Project management effort was also expended on Task 2, Early Flight Demonstration. That task has been started, as described below, but is not yet complete.

Delivery Milestone D2, Task T1, Technical Advisory Committee (TAC) Review of Project: This review was hosted at Ball Aerospace on November 9th, 2015.

Delivery Milestone D4, Task T2, Early Flight Test and Data Collection: This activity and milestone had not been planned until Q2 of the project. However, the project team had an opportunity to start this work early and the task is >90% complete. Specific technical accomplishments to get ready for flight have been as follows:

- Instrument performance modeling (including radiometric modeling of the environment)
- All necessary components procured for a methane whisk-broom DIAL sensor
 - ❖ Note that the methane laser assembly comes from a Ball internal R&D effort and is being contributed as Resource matching
- Limited de-integration of the earlier, CRAD-developed DIAL instrument to detect propane and longer-chain alkanes
- Mechanical and electrical re-integration of the instrument for methane (natural gas) detection
- Software updates – as needed for the methane embodiment of the instrument
- Instrument re-alignment and ground testing using the “laser trailer” as a mobile laboratory

After initial ground testing, the whisk broom instrument was integrated into a Cessna TU206 aircraft. A short duration flight was accomplished on the afternoon of December 17th and several hours of data with methane release were collected on December 18th. Winds were very high (10 to 30 mph) on the 18th and there were some anomalies that affected data quality.

There were two technical objectives of the Early Flight Test for RASMLS:

- First, the data and instrument performance are intended to guide the design of the “next-generation” RASMLS instrument. This objective has already been well met. The issues and “lessons-learned” will be applied to RASMLS.
- Second, the gas concentration data and local meteorological data such as wind speed, are to be used for path-finding the leak rate quantification algorithms. It is not yet clear if we have enough data (or good enough data) to satisfy this second objective. Analysis and post-processing is ongoing as of this report.

2.0 Business Status –

2.1 Budget Analysis: Budgeted, Actual and Cumulative Expenditures

Project cost from inception to date (through December 19, 2015) are \$229,248.

This is substantially higher than is being billed through the first Quarter for Delivery Milestones D1 and D2, which is \$51,020.

However, since Task 2, Early Flight Testing (Delivery Milestone D4) is >%80 complete, as evidenced by the progress reported in Section 1.1, we should include the earned value for that activity which is 90% of 89,282 which equals \$80,354. When this is included, the earned value against the project plan is $\$80,354 + \$51,020 = \$131,374$

This analysis indicates that the project has incurred about \$97,874 more cost than anticipated for the work accomplished. The best area for future cost reduction is in Task T3, the RASMLS-specific instrument prototyping. We will need to use the “lessons-learned” from Task T2 and our experience with ground and flight testing to improve the efficiency and lower the cost of those future tasks.

2.2 Contributions Analysis

Delivery Milestone D1, Task T0: The Cost Share contribution associated with Delivery Milestone D1 and Task T0 has been made. This was achieved by obtaining a copy of the DIAL Instrument Performance Model (IPM) for use on RASMLS, which was developed using prior-year internal R&D funding.

Delivery Milestone D4, Task T2: The Cost Share contribution associated with Delivery Milestone D4 has not yet been fully realized. We had proposed in-kind support that include use of an appropriately modified aircraft, simulated leaks from their Livermore test facility and support of pilots, engineers and gas operations field technicians. Alternative, in-kind Cost Share that had not been planned is as follows:

- Flight work done on Task T2, thus far has been done by Ball Aerospace. The flight activities described in Section 1.1 were funded by our Airborne Initiative. This includes internal labor-hours and the cost of aircraft operations which were subcontracted locally.
- Additionally, Ball initiated internal R&D in May of 2015 (after the RASMLS proposal had been submitted, and before the contract award at the end of September). This IR&D funding was for the purpose of facilitating the reconfiguration of the whisk-broom sensor from hazardous liquid leak detection to natural gas leak detection. Between May of 2015 and the completion of the first flight testing for natural gas, substantial investment in design, fabrication, procurements and integration and test activities.
- Ball continues to work with collaborators and anticipates monetary support for additional flight testing.

Other Delivery Milestones and Tasks: There are no Tasks, in addition to those above, either in-work or completed, that have Cost Share contributions that need to be reported.

3.0 Schedule

The project Pert chart and schedule is show in **Figure 2** (next page). All tasks that were planned for Q1 have been completed. Task 2 is >90% complete as of the end of Q1, making this task significantly ahead of schedule.

4.0 Payable Milestones

As described in Sections 1 and 1.1, above, payment Delivery Milestones D1 and D2 have been achieved and should be invoiced this quarter. The invoice amount should match the payment plan from the Agreement, Attachment 5.

Although Task 2 is 90% complete, we are not quite ready to invoice for payment Delivery Milestone D4.

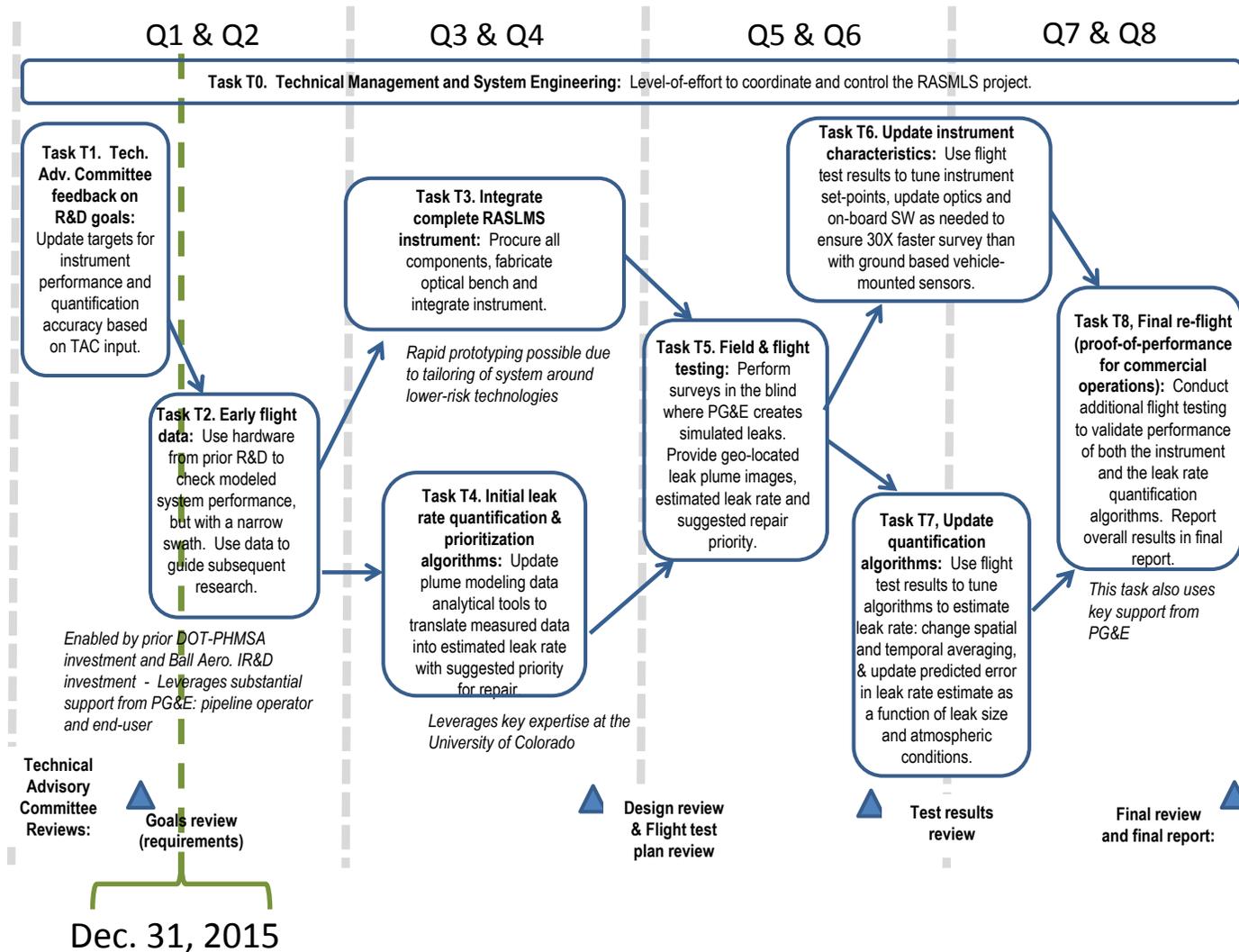


Figure 2, RASMLS project is slightly ahead of schedule. All Tasks that were to be completed in Q1 are complete and Task T2 is >90% complete in Q1, making that task ahead of schedule.

