

**Unmanned Aerial Systems for Transportation
Decision Support**

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COOPERATIVE AGREEMENT
No. OASRTRS-14-H-UVM

Quarterly Progress Report #3

April 1, 2015 through June 30, 2015



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Glossary

3D	Three Dimensional
AASHTO	American Association of State Highway Transportation Officials
CAD	Computer-Aided Design
CNL	Cognition Network Language
COA	Certificate of Authorization
CRS	Commercial Remote Sensing
DOT	Department of Transportation
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
GIS	Geographic Information Systems
HDSS	Hazard Data Distribution System
ICS	Incident Command System
LiDAR	Light Detection and Ranging
NAIP	National Agricultural Imagery Program
NIMS	National Incident Management System
NOAA	National Oceanic and Atmospheric Administration
OBIA	Object-Based Image Analysis
OGC	Open Geospatial Consortium
PI	Principal Investigator
PM	Program Manager
RiP	Research in Progress database
RITA	Research and Innovative Technology Administration
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SAL	Spatial Analysis Laboratory (University of Vermont)
SI	Spatial Information
TAC	Technical Advisory Committee
TRC	Transportation Research Center
UAV	Unmanned Aerial Vehicles
USDOT	United States Department of Transportation
USGS	United States Geological Survey
UVM	University of Vermont
VAOT	Vermont Agency of Transportation (also known as Vtrans)
VTrans	Vermont Agency of Transportation (also known as VAOT)
XML	eXtensible Markup Language

Executive Summary

Commercial remotely sensed datasets have tremendous value for a broad range of transportation-related activities, but their full potential is often constrained by inadequate temporal resolution, poor spatial resolution, and high acquisition costs. Unmanned Aerial Systems (UAS) have the potential to overcome these limitations, radically changing the way remote sensing data are used for transportation planning, operations, maintenance, and program development. Contemporary off the shelf UAS are inexpensive to purchase, easy to operate with proper training, rapidly deployable, and provide data with spatial resolutions that cannot be matched by traditional airborne and spaceborne platforms. This supplemental funding will be used to expand the operational capacity of the UAS portion of our project, addressing the needs of state transportation agencies. This project will apply proven UAS acquisition and analytical capabilities in four categorical areas that have been determined to be of high interest by stakeholders: 1) geomorphic assessment, 2) construction management and phasing, 3) resource allocation during disaster response, and 4) cost decision support. We will marry this with a robust outreach and training program that will improve the abilities of state and local transportation planners to integrate UAS data and products into their decision-making and management operations. The activities in all four areas will develop operational solutions with quantifiable results that improve decision making, reduce costs, increase life safety, and provide a measurable impact on existing decision processes, models and resource tasking.



The above figure provides a sample of data the project team collected at the Morrisville Alternative Truck Route Project in Vermont. This data was used to calibrate fill calculation models, but will also serve to demonstrate construction phasing and progress.

Technical Status

Task 1: Project coordination

The supervision, scheduling, and phasing of personnel and resources associated with the project.

Output/Deliverables: Finalized project timeline, acquisition of equipment and needed supplies and relay of project team effort to team members.

Accomplishments:

Provide a clear and complete account of work performed on each task and its relationship to task objectives and milestones.

- Internal project meetings were held to finalize plans for summer UAS operations and flights.
- Section 333 application materials were filed to the FAA to facilitate UAS operations in states aside from Vermont.
- UAS equipment was priced and was purchased in June 2015. The manufacturer provided training. Test and calibrations flights were conducted.

Problems Encountered:

Describe any problems encountered or anticipated that will affect the completion of the agreement within the time and fiscal constraints as set forth in the agreement, together with recommended solutions to such problems, or a statement that no problems were encountered.

- The filing of the Section 333 application was delayed until June as UAS Working Group was started at UVM to review all UAS activity at the University.

Future Plans:

Discuss work planned for the next period and its relationship to the present period. Provide an outline of the work to be accomplished during the next report.

- Update website with new information as it becomes available.
- Additional TAC meetings.
- Continue to review and revise project team effort as some team member efforts have changed and will change which is detailed below.

Schedule:

Highlight any changes to the schedule as previously reported.

- None

Effort Expended:

Effort expended by task for all staff categories must be reported.

Employee Name/ Labor Category	Budgeted Hours	Year 1 (hours)				Cummulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	63	0	0	2.5		2.5
Amanda Hanaway	2	2	0	0		2
Jacob Leopold	8	0	0	0		0
Sean MacFadden	0	0	0	0		0
Ernest Buford	0	0	0	0		0
Zachary Borst	0	0	0	6		6
Technician	0	0	0	0		0

*Note: Program Manager Amanda Hanaway has left the University of Vermont and Jacob Leopold has taken over as program manager, Jacob has been involved in the program's development and administrative management since its inception. Certain technical aspects of Amanda's assigned task hours have been reassigned to Zachary Borst. In an effort to keep the cost of the project the same, the number of hours were factored by the difference in salaries (1 hour of Amanda's time = 1.5 hours of Zachary's time). Jacob Leopold will be directly charged in future fiscal years to this project and his hours have equally been assigned to keep the cost of the project the same (1 hour of Amanda's time = 1.1 hours of Jacob's time).

Task 2: Reporting

Activities related to reporting progress and results to the funding agency including quarterly reports and final reports, all submitted to DOT.

Output/Deliverables: White papers; Quarterly reports, draft and final reports; Revised project activities and deliverables as needed.

Accomplishments:

Provide a clear and complete account of work performed on each task and its relationship to task objectives and milestones.

- This Quarterly Report has been added to the website.

Problems Encountered:

Describe any problems encountered or anticipated that will affect the completion of the agreement within the time and fiscal constraints as set forth in the agreement, together

with recommended solutions to such problems, or a statement that no problems were encountered.

- None.

Future Plans:

Discuss work planned for the next period and its relationship to the present period. Provide an outline of the work to be accomplished during the next report.

- Update the website by uploading and linking TAC meeting minutes and Quarterly Reports.

Schedule:

Highlight any changes to the schedule as previously reported.

- None.

Effort Expended:

Effort expended by task for all staff categories must be reported.

Employee Name/ Labor Category	Budgeted Hours	Year 1 (hours)				Cummulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	33	0	0	2		2
Amanda Hanaway	12	6	6	0		12
Jacob Leopold	60	0	0	0		0
Sean MacFadden	0	0	0	0		0
Ernest Buford	0	0	0	0		0
Zachary Borst	70	0	0	6		6
Technician	0	0	0	0		0

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Task 3: Stakeholder/partnership meetings

Establish the advisory committee and carry out meetings with external groups and collaborators, including state transportation departments, industry partners, and the

advisory committee. Meetings include: project kick-off, advisory committee updates, meetings with local/state transportation agency personnel, selection of UAS flight sites, industry/commercial integration partner meetings, and stakeholder decision support feedback. The committee will review project progress and provide guidance throughout the life of the project.

Output/Deliverables: Create an advisory board of transportation agencies members and subject matter experts; Meeting notes.

Accomplishments:

Provide a clear and complete account of work performed on each task and its relationship to task objectives and milestones.

- Internal project team meetings have occurred on a regular basis.
- A UAS flight demonstration was held for staff from the Central Vermont Regional Planning Commission on May 1, 2015.
- Collaborative UAS flights were done with Airshark, a Vermont-based private UAS company on May 18, 2015.
- UAS flight training was carried out for Vermont Agency of Transportation personnel on May 18, 2015.
- A UAS flight demonstration was held for the Vermont GIS community following the Vermont Geospatial Forum conference on June 2, 2015.
- Outreach activities were conducted with a private company, GroundAerial, who had questions about the UAS technology developed for this project, via telecon on June 3, 2015.
- An overview of UAS technology and flight operations were held for Dubois & King, an engineering consulting firm with numerous transportation contracts throughout the state, on June 4, 2015.
- A rapid response team was deployed to Richmond, VT at the request of the Vermont Agency of Transportation on June 18, 2015 to collect imagery of a road that washed out during a severe rain storm. Data were provided to local and state transportation officials.
- UAS flight operations were carried out in support of a bike and pedestrian study in North Hyde Park, VT on June 24, 2015. Data were shared with Dubois & King, the engineering firm contracted to perform the work.
- UAS flight operations were carried out in support of a bike and pedestrian study in Barre, VT on June 26, 2015. Data were shared with Dubois & King, the engineering firm contracted to perform the work.
- UAS flight operations and a demonstration were conducted for officials and planners from the Town of Plainfield, VT, Malone and McBroom consulting, and Two Rivers Survey in support of bridge construction to be down in Plainfield on June 25, 2015.

- An overview of UAS technology and project findings were given to Stantec, an engineering consulting firm with numerous transportation contracts throughout the state on July 16, 2015.

Problems Encountered:

Describe any problems encountered or anticipated that will affect the completion of the agreement within the time and fiscal constraints as set forth in the agreement, together with recommended solutions to such problems, or a statement that no problems were encountered.

- There have been significant scheduling delays in the initial TAC meeting. It is our goal to have a minimum of five external members for the TAC Kick-off meeting which has not yet been accomplished. Full TAC meeting was not possible due to schedule conflicts. Meetings with individual TAC members were held.

Future Plans:

Discuss work planned for the next period and its relationship to the present period. Provide an outline of the work to be accomplished during the next report.

- The TAC will meet in person or by video conference twice per year or on an as needed basis. Notes will be taken at each meeting and provided to members as a brief summary report.
- Next TAC Meeting is still being scheduled.
- Internal project team meetings to occur on a regular basis.

Schedule:

Highlight any changes to the schedule as previously reported.

- None.

Effort Expended:

Effort expended by task for all staff categories must be reported.

Employee Name/ Labor Category	Budgeted Hours	Year 1 (hours)				Cummulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	51.5	0	0	20		20
Amanda Hanaway	269.3	16.38	16.34	2.03		34.75
Jacob Leopold	0	0	0	0		0
Sean MacFadden	47	0	0	0		0
Ernest Buford	0	0	0	0		0
Zachary Borst	270	56.88	81.25	6.43		144.56
Technician	0	0	0	0		0

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Task 4: UAS Operations

Planning, data acquisition, and data processing associated with UAS operations.

Output/Deliverables: Flight plans; UAS operating guidelines to include a UAS equipment checklist, UAS flight checklist, UAS operating procedures and manual.

Accomplishments:

Provide a clear and complete account of work performed on each task and its relationship to task objectives and milestones.

- 144 UAS flights were conducted during this reporting period.
- Dual-UAS flight operations were carried out in which two UAS systems operated simultaneously in the same airspace.
- UAS equipment checklists and flight checklists were converted to a digital, cloud-based, mobile-friendly platform.
- 2.3 TBs of UAS data products were generated during this reporting period.
- Field-based mobile data collection activities using the Fulcrum app were conducted in conjunction with flight operations for two locations.
- Flight operations were conducted for the new UAS, the senseFly eBee RTK. Equipment and flight checklists were created for the new system.

Problems Encountered:

Describe any problems encountered or anticipated that will affect the completion of the agreement within the time and fiscal constraints as set forth in the agreement, together with recommended solutions to such problems, or a statement that no problems were encountered.

- None

Future Plans:

Discuss work planned for the next period and its relationship to the present period. Provide an outline of the work to be accomplished during the next report.

- Continued UAS flight operations and data collection is support of the project objectives.

Schedule:

Highlight any changes to the schedule as previously reported.

- None.

Effort Expended:

Effort expended by task for all staff categories must be reported.

Employee Name/ Labor Category	Budgeted Hours	Year 1 (hours)				Cummulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	40	0	0	4		4
Amanda Hanaway	0	0	0	0		0
Jacob Leopold	0	0	0	0		0
Sean MacFadden	279	0	81.25	81.25		162.5
Ernest Buford	0	0	0	81.25		81.25
Zachary Borst	48	10	0	0		10
Technician	2507	0	0	443.25		443.25

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Task 5: Decision Support Tools

Decision support tools to support the four categorical areas: Geomorphic assessment, Construction management and phasing, Resource allocation, and Cost decision support.

Output/Deliverables:

Geomorphic assessment: 2D orthophoto mosaics, 3D point clouds, Updated hydrologic network in GIS format, Stream cross sections and morphological change, Geomorphic assessment report, Comparison of UAS-based geomorphic assessment to field-based ones. Construction management and phasing: 2D orthophoto mosaics, 3D point clouds, GeoPDF visualization products, Web-based multi-temporal mapping portal, Mobile construction phasing assessment tool. Resource allocation: KML image chip files, 2D compressed orthophoto mosaics, Best practices/NIMS integration white paper. Cost decision support: Updated fill estimation/cost estimation tool, Web-based mapping portal.

Accomplishments:

Provide a clear and complete account of work performed on each task and its relationship to task objectives and milestones.

- A web-based viewer for the UAS imagery was developed for two recent missions to showcase the ability to swipe between multi-temporal UAS imagery.
- Over 20 cartographic products were generated from the various flights that occurred during this quarter and these products were shared with partners.

Problems Encountered:

Describe any problems encountered or anticipated that will affect the completion of the agreement within the time and fiscal constraints as set forth in the agreement, together with recommended solutions to such problems, or a statement that no problems were encountered.

- None

Future Plans:

Discuss work planned for the next period and its relationship to the present period. Provide an outline of the work to be accomplished during the next report.

- Continue to develop the UAS online data viewer.

Schedule:

Highlight any changes to the schedule as previously reported.

- None.

Effort Expended:

Effort expended by task for all staff categories must be reported.

Employee Name/ Labor Category	Budgeted Hours	Year 1 (hours)				Cumulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	82.44	0	0	0		0
Amanda Hanaway	4	0	0	0		0
Jacob Leopold		0	0	0		0
Sean MacFadden	295	0	0	81.25		81.25
Ernest Buford	0	40.62	121.88	81.25		243.75
Zachary Borst	0	0	0	0		0
Technician	631.1	0	0	0		0

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Task 6: Training and Outreach

Host workshop and online "virtual campus" tutorials and data. Training data will be assembled from the missions conducted in task 4. Three videos will be produced to UAS decision support tools. A training manual will be compiled for the workshop. A workshop on UAS decision support tools will be given in UVM's geospatial teaching facility and feedback from attendees will be gathered. All materials will be posted online for universal access.

Output/Deliverables: Workshop on UAS products for transportation decision support; online training materials including videos, sample data, and step-by-step manuals.

Accomplishments:

Provide a clear and complete account of work performed on each task and its relationship to task objectives and milestones.

- A new video was published on June 12, 2105 documenting the work done to map erosion in Barre, VT that has disrupted the transportation network in the past - <https://youtu.be/SJThRjBFTsE>
- Data from over 30 flights, totaling 87GBs, has been shared with state, local, and private sector partners during this period.
- The UAS capabilities fact sheet was updated and distributed to partners.

- A fact sheet on UAS mapping of stream debris was produced.

Problems Encountered:

Describe any problems encountered or anticipated that will affect the completion of the agreement within the time and fiscal constraints as set forth in the agreement, together with recommended solutions to such problems, or a statement that no problems were encountered.

- None.

Future Plans:

Discuss work planned for the next period and its relationship to the present period. Provide an outline of the work to be accomplished during the next report.

- Continued outreach to state and local transportation agencies along with the consulting firms hired to perform transportation work.

Schedule:

Highlight any changes to the schedule as previously reported.

- None.

Effort Expended:

Effort expended by task for all staff categories must be reported.

Employee Name/ Labor Category	Budgeted Hours	Year 1 (hours)				Cummulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	9	0	0	0		0
Amanda Hanaway	45	0	0	0		0
Jacob Leopold	0	0	0	0		0
Sean MacFadden	55	0	0	0		0
Ernest Buford	0	0	0	0		0
Zachary Borst	325	0	0	0		0
Technician	0	0	0	0		0

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time). Jacob Leopold will be direct charged in future fiscal years to this project and his hours have equally been assigned to keep the cost of the project the same (1 hour of Amanda's time = 1.1 hours of Jacob's time).

Task 7: Publications/Presentations

Documentation of the project and its results in conference/journal publications and conference presentations. Development of training and operational materials for dissemination to stakeholders.

Output/Deliverables: A paper submitted to a conference or peer-reviewed journal; A conference presentation of the results.

Accomplishments:

Provide a clear and complete account of work performed on each task and its relationship to task objectives and milestones.

- Jarlath O'Neil-Dunne gave an overview of the UAS technology used in the project at the Vermont National Guard Intelligence Symposium on May 17, 2015
- Jarlath O'Neil-Dunne gave an overview of the project to the Department of the Interior UAS group via webinar on May 13, 2015
- An article on our project was featured on web site "Inside Unmanned Aerial Systems" on May 30, 2015 - <http://go.uvm.edu/xxrtq>
- An article by Jarlath O'Neil-Dunne was published in xyHT Maganize - O'Neil-Dunne, J.P.M. 2015. GIS-Ready sUAS. xyHT Magazine, June 2015: 37-39. URL: <http://bt.e-ditionsbyfry.com/publication/?i=258885>
- Jarlath O'Neil-Dunne gave a presentation "Unmanned Aerial Systems For GIS-Ready Mapping" at the 2105 Vermont Geospatial Forum in Montpelier, VT on June 2, 2015 - http://vcgi.vermont.gov/geospatialforum_2015
-

Problems Encountered:

Describe any problems encountered or anticipated that will affect the completion of the agreement within the time and fiscal constraints as set forth in the agreement, together with recommended solutions to such problems, or a statement that no problems were encountered.

- None.

Future Plans:

Discuss work planned for the next period and its relationship to the present period. Provide an outline of the work to be accomplished during the next report.

- Presentation to the Vermont Agency of Transportation executive staff is scheduled for July 20, 2015.

Schedule:

Highlight any changes to the schedule as previously reported.

- None.

Effort Expended:

Effort expended by task for all staff categories must be reported.

Employee Name/ Labor Category	Budgeted Hours	Year 1 (hours)				Cummulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	36	0	0	4		4
Amanda Hanaway	46	0	0	0		0
Jacob Leopold		0	0	0		0
Sean MacFadden	19	0	0	0		0
Ernest Buford	0	0	0	0		0
Zachary Borst	52	0	0	0		0
Technician	0	0	0	0		0

Task 8: Business Plan Development

Cost accounting to support the development of a business plan to enable UAS services to be offered to state and local transportation agencies once the RITA project has come to a conclusion.

Output/Deliverables: Business plan to include Cost Accounting, Rate Calculations, Market Analysis and Plan, Management Team, and Revenue Projections.

Accomplishments:

Provide a clear and complete account of work performed on each task and its relationship to task objectives and milestones.

- Project team has continued collection data to support cost accounting and rate calculations.
- Continued discussions with state and local transportation officials on UAS capabilities, limitations, and costs.
- Additional meetings with private sector groups to discuss adding UAS capabilities to transportation consulting operations.

Problems Encountered:

Describe any problems encountered or anticipated that will affect the completion of the agreement within the time and fiscal constraints as set forth in the agreement, together with recommended solutions to such problems, or a statement that no problems were encountered.

- None.

Future Plans:

Discuss work planned for the next period and its relationship to the present period. Provide an outline of the work to be accomplished during the next report.

- Continue to collect data to support cost accounting.

Schedule:

Highlight any changes to the schedule as previously reported.

- None.

Effort Expended:

Effort expended by task for all staff categories must be reported.

Employee Name/ Labor Category	Budgeted Hours	Year 1 (hours)				Cummulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	10	0	0	0		0
Amanda Hanaway	20	0	0	0		0
Jacob Leopold		0	0	0		0
Sean MacFadden	20	0	0	0		0
Ernest Buford	0	0	0	0		0
Zachary Borst	20	0	0	0		0
Technician	0	0	0	0		0

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Business Status

Labor-Hours Expended for the Program

Provide a tabulation of the planned, actual and cumulative labor-hours expended for the program.

Employee Name/ Labor Category	Total Budgeted Hours	Year 1 (hours)				Cummulative (hours)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunne	324.94	0	0	32.5		32.5
Amanda Hanaway	536.30	24.38	22.34	2.03		48.75
Jacob Leopold	0.00	0	0	0		0
Sean MacFadden	715.00	0	81.25	162.5		243.75
Ernest Buford	0.00	40.62	121.88	162.5		325
Zachary Borst	715.00	66.88	81.25	18.43		166.56
Technician	3,138.10	0	0	443.25		443.25

Funds Expended for the Program

Provide a chart showing current and cumulative expenditures versus planned expenditures

Employee Name/ Labor Category	Total Invoiced for Salary	Year 1 (Invoiced Salary)				Cummulative (Invoiced Salary)
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Jarlath O'Neil Dunn	\$27,258.50	\$0.00	\$0.00	\$2,715.52	\$0.00	\$2,715.52
Amanda Hanaway	\$28,338.58	\$1,896.99	\$1,738.26	\$0.00	\$0.00	\$3,635.26
Amanda Hanaway (Cost Share)	\$19,882.95	\$628.54	\$0.00	\$0.00	\$0.00	\$628.54
Jacob Leopold	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Sean MacFadden	\$47,012.92	\$0.00	\$5,244.48	\$10,428.16	\$0.00	\$15,672.64
Ernest Buford	\$0.00	\$2,417.70	\$7,254.30	\$9,719.39	\$0.00	\$19,391.39
Zachary Borst	\$36,136.03	\$3,318.06	\$4,030.98	\$127.43	\$0.00	\$7,476.47
Zachary Borst (Cost Share)	\$0.00	\$2,401.57	\$2,404.56	\$1,056.66	\$0.00	\$5,862.79
Technician	\$79,521.13	\$0.00	\$0.00	\$10,655.77	\$0.00	\$10,655.77
Non-Salary Expenditures	\$15,795.55			\$1,888.66		\$1,888.66
Non Salary Cost Share	\$214,180.05			\$23,432.27		\$23,432.27
Total	\$468,125.71	\$10,662.86	\$20,672.59	\$60,023.86	\$0.00	\$91,359.30
Cost Share:	\$234,063.00	\$3,030.11	\$2,404.56	\$24,488.93	\$0.00	\$29,923.60
Invoiced:	\$234,062.71	\$7,632.75	\$18,268.03	\$35,534.93	\$0.00	\$61,435.70
Total:	\$468,125.71	\$10,662.86	\$20,672.59	\$60,023.86	\$0.00	\$91,359.30

Cost Share:

- \$3,200 in Facility Rental Fee, Custodial Services and Catering Work Orders are requested for a GIS and Remote Sensing Tools workshop to be held at the University of Vermont.

- \$5,000 in Personnel Time, \$10,000 in Technical Support, \$9,000 in web-based software training, and \$1,000 in Sensor leasing all as cost-share from senseFly.
- \$123,090 of cost-share for Quick Terrain licenses for workshops, and \$2500 for a 2 day training session for Quick Terrain modeler.
- \$6,750 for UAS Business Development, \$1200 in Travel Costs, \$1500 for Data Storage and \$3750 for data processing all as cost share from Spatial Informatics Group
- \$17,976 for Fulcrum Team License, \$7560 for the Premium Support Package, \$4000 for On-Site Training and \$5000 for Image Processing and Conversion, all as cost share from Spatial Networks.
- *Unmanned aerial systems will be purchased on this project in year 1 for the purpose of assessing the volume of fill needed to repair damaged roads. One UAS will be purchased for \$24,432.27; \$23,432.27 as cost share.
- NOTE: The total cost share listed above is \$224,526. However, we only need \$219,894.40, so that's all we committed to in the financial reporting.

Budget for Non-Salary Expenditures:

Equipment (*see note above)	\$1,000.00
Facility Fees, Custodial Work Orders, UVM Services	\$4,880.00
<u>Travel (**see note below)</u>	<u>\$9,915.55</u>
Grand Total	\$15,795.55

**Note: This request includes an estimated cost for regional travel to meet with agencies and collaborators, collect reference data, and launch unmanned aerial vehicles.

Meetings

List of Advisory Committee Meetings to Date:

- Planned for late May.

List of Meetings with the USDOT Project Management Team:

- April 27 in Oklahoma.

Presentations

- None yet.

Partnerships

The Project Team has been collaborating not only with the project's Technical Committee, but the following organizations as well:

- Vermont Agency of Natural Resources. UAS data collection for streams that contribute
- Vermont Agency of Transportation. Spring flood and ice jam transportation risk mapping. Airspace integration.
- Central Vermont Regional Planning Commission. Gathering data to support
- Spatial Informatics Group. Commercial sector integration.
- Fitzgerald Environmental. UAS support to transportation consulting projects.
- Applied Imagery. Commercial software integration.
- senseFly. UAS training, support, and sensor testing.

Quarterly Report Submission Timeline

If the submission due date is a holiday/weekend please ensure that the submission is made by the subsequent business day. Deliverables covering partial periods of performance up to one month will be rolled over into the subsequent quarterly progress report.

- Quarterly Report for Period covering April 01 to June 30 is due by July 15
- Quarterly Report for Period covering July 01 to Sept. 30 is due by October 15
- Quarterly Report for Period covering October 01 to December 31 is due by January 15