The Connected Vehicle Pilot Deployment Program, Phase 1

Volume I: Technical

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Technical/Management Approach

Tampa Hillsborough Expressway Authority (THEA) owns and operates one of the most unique, award-winning toll roads in the world, the Lee Roy Selmon Expressway Reversible Express Lanes (REL). THEA also manages/maintains several connector surface streets, providing an ideal deployment site for a connected vehicle pilot. THEA is a leader in bringing emerging technologies to bear to solve real issues as evidenced by the first tolled expressway to convert to all electronic tolling (AET); first reversible express lanes; and first to use image based tolling in Florida. Further advantages of THEA that make it a valuable choice as a Connected Vehicle Pilot Deployment Offerer are: dedicated team that’s nimble and responsive; supportive legislature and business community; and strong, long-lasting agency and private-sector partnerships.

THEA’s ability to be nimble and responsive lies in its ability to supplement employee staff with SME consultant staff under GEC contracts. When needs arise, these consultants integrate into the organization and work as an extension of THEA staff. Our GEC contracts have provisions that allow THEA to right-size staff augmentation to meet those needs. THEA’s management and technical approach for this pilot is to utilize our internal staff to provide overall program management, key communications and control of contractual issues, while drawing upon its extensive network of consultant SMEs for the technical specialty areas. The THEA team’s relevant experience and pedigree in Connected Vehicle (CV) technologies assures USDOT we understand the technology and its application to deliver successful, meaningful and measurable outcomes. This knowledge also helps us discover the challenges and risks of this Pilot and the ability to appropriately resolve or mitigate them.

The following parts of Volume 1 describe the approach for each of the tasks identified in the solicitation, our approach to staffing this first phase and beyond, and a structured and comprehensive approach to deployment. Collectively, these sections will demonstrate THEA’s qualification and readiness to be a valuable partner to USDOT, other CV Pilots in Florida and across the country.

THEA is dedicated to support the USDOT’s goals of the CV Pilot Deployment program by spurring innovation; building and strengthening public and private partnerships; sharing data and lessons learned for the good of all; maintaining and sustainably growing a permanent CV deployment site and USDOT Affiliated Testbed; while providing the institutional and financial models that can support long-term sustainable growth without the need for dedicated federal funding.

Joe Waggoner
Executive Director & Principal Proposal Author
Tampa Hillsborough Expressway Authority
Task 1 – Program Management

The key to success on advanced technology programs, such as this USDOT Connected Vehicle Pilot Deployment Program, is employing a detailed Program Management Plan (PMP) and leveraging skilled program leadership from the entire team. The THEA team will deploy a rigorous and proven program management approach as described below.

1.1 KICK-OFF MEETING

This pilot will deliver measurable, meaningful and documented outcomes. The kick-off meeting will be formatted as a “success management” workshop, focusing on ensuring the contracting officer’s representative’s (CORs) requirements and expectations are met during the entire performance period of this effort.

1.2 PROGRAM MANAGEMENT PLAN

The PMP is the primary tool used by the team to ensure the program stays on track, follows a systematic approach, and meets obligations of the COR. The THEA team will base the PMP on proven project management body of knowledge (PMBOK) principles. Robert Frey, the Agency Program Manager, and Steven Johnson, Program Management Leads (PML) for this Phase of the THEA Connected Vehicle Pilot, are well-versed in the Project Management Institute framework. The PMP is shared with all task leaders and stakeholders. The THEA team will develop a draft PMP within 15 days of contract award and use the document as a guide during the kick-off meeting.

The baseline scope for Phase 1 will be established in a clear statement of work with detailed task descriptions and a work breakdown structure (WBS) that clearly delineates the tasks which result in deliverables. The WBS is outlined in the tasks of the CPM schedule (Figure 1-1 on the next page). The CPM schedule will leverage the USDOT and THEA team member’s experience from the Safety Pilot Model Deployment and other connected vehicle activities. The Schedule Management Plan will include weekly meetings with task leaders to identify and address schedule adherence. Schedule risks will be identified quickly and addressed through the Risk Management Plan. If tasks are not keeping pace with the baseline schedule, mitigation efforts will be undertaken to bring the task back in line.

The THEA leadership team will prepare a scope management plan that presents a clear approach to managing risks associated with scope changes. The technical concepts developed during Phase 1 may change over the next 3 years due to technological advances, enhancements of standards, or functional obsolescence. A change management plan and process will be developed to manage changing requirements over time. THEA will leverage its existing change management plan and process to meet the needs of the program.

Clear lines of communication are necessary between single points of contact at THEA and the USDOT for important decisions. A “laddered” relationship matrix will be developed to align technical resources on the project team with USDOT resources for information sharing. It is important to have subsidiary lines of communication for task areas such as media relations, where THEA communications professionals can interact directly with Mike Pina and others at USDOT. In many cases, it is not necessary that communications be funneled through program leadership, unless decisions are required that affect overall program scope, schedule or costs. Routine communications can be peer-to-peer to establish and strengthen such relationships for subsequent phases.

Steve Johnson (PML) will be responsible for implementation of a team-wide Quality Assurance and Control Plan, supported by a dedicated QA/QC team. Steve will work with the QA/QC team to develop the plan,
Configuration management is necessary to ensure system stability, repeatability, traceability and maintainability. During the concept development phase, document control and traceability from initial concept development through requirements definition are critical. This traceability will be carried forward into Phases 2 and 3, as the system is designed, built, integrated, tested, operated and maintained.

The THEA team will maintain a risk register, derived from the risk register commonly recommended by USDOT (Figure 1-2). Possible risks will be identified and presented at the Kick-Off Meeting with USDOT. This will offer an early opportunity to discuss collaborative ways to mitigate such risks. The risk management plan will address: risk identification; risk avoidance through proactive monitoring and management; strategies to assess and eliminate risk; assignment of responsibility for addressing the risks; and monitoring risks and mitigation actions on a continuous basis. For each potential risk, the probability of occurrence (P) and the impact of the risk (I) will be assessed. A plan will then be defined to develop mitigation actions based on the potential impact.

1.3 STAKEHOLDER ENGAGEMENT
To maximize stakeholder interest and involvement, THEA has already begun engaging many of these stakeholders as partner organizations, as they have been active participants in the development of the preliminary concept. This understanding has been reached through inter-governmental memorandums of understanding (MOUs) and letters of support/commitment. Additional stakeholders will be identified early in the project and actively engaged in the concept development phase. The Stakeholder/Partner register will be maintained by the PML and will be updated as the concept is refined to include potential new stakeholders with an interest in the project. Additional information related to THEA’s stakeholders and partners can be found in Volume 1, Part 3.

1.4 REPORTS
The THEA team communications plan includes monthly and annual reporting. Monthly progress reports will document progress on deliverables, accomplishments, anticipated activities, schedule updates, and cost to complete. The risk register will also be updated and a risk report will detail mitigation activities and risk status. THEA will provide an annual report one month prior to the completion of Phase 1. This report will focus on contract performance and management criteria (Quality, Schedule, Cost Control, Personnel and Subcontractor Management).

Task 2 – Pilot Deployment — Concept of Operations
The activity of developing the Concept of Operations (ConOps) is the most important to successful project because it involves stakeholders coming together to openly discuss each other’s needs and issues, agree on a common set of goals to be achieved within a set period, and define how accomplishments will be monitored and measured. The THEA team, its partners and stakeholders have initiated a needs-based approach to
identify specific, measurable problems within the pilot deployment area. These needs, their locations, and potential CV Applications to consider are detailed in Volume 1, Part 3. Prior to the development of the ConOps, THEA will submit a summary of identified draft needs for COR review. COR comments will be addressed in the final needs summary.

THEA will develop the ConOps in accordance with the Federal Highway Administration (FHWA) Guidebook and the IEEE Standard (section 4). The THEA team will employ tools maintained by the USDOT to support the development of the Concept of Operations. These tools include the CVRIA and SET-IT. THEA will use the SET-IT application to create a schematic context diagram for inclusion in the ConOps. This context diagram will graphically communicate a high-level physical description of the proposed system. The Concept of Operations will follow IEEE/ISO standards. Other elements of our approach are outlined below.

THEA understands how important stakeholder engagement and alignment with program objectives are for program success. THEA has forged strong, long-lasting partnerships with various stakeholders in West Florida to integrate transportation, mobility, environmental, and safety solutions for the benefit of the citizens, businesses, and visitors of West Florida. THEA’s approach to stakeholder interaction is to continue to build on what works. The City of Tampa’s Traffic Management Center (TMC) is co-located with THEA’s TMC. The two agencies have forged a strong partnership that started years before the opening of the Selmon Expressway Reversible Express Lanes and the building of their new TMC. The jointly-operated TMC is a testament to the dedication of THEA and the City of Tampa to this approach. Only through open dialogue and being empathetic to each other’s needs can these types of long-lasting partnerships be built or sustained.

THEA will employ a series of workshops to elicit stakeholder needs to map those needs to requirements, and to define solutions that meet the needs of the stakeholder community. A workshop will be scheduled to correspond to decision points in the concept development phase where stakeholder feedback will be most important. We anticipate a minimum of four such workshops in the Tampa Bay area during the 12 month concept development phase. THEA will identify a subset of the stakeholder registry to participate in the ConOps walkthrough. This subset of stakeholders shall comprise the stakeholder review panel, and the draft panel roster will be submitted for COR review. THEA will prepare and submit a comment resolution report describing the resolution of all comments from the walkthrough. We understand that the COR must review and approve all comment resolutions before the report is considered final. THEA will deliver a one-hour webinar describing the approved deployment concept for all interested stakeholders. THEA understand that the intent of the webinar is to reach the larger connected vehicle community. We will track off-line comments and questions during the webinar and provide a verbal response before ending the webinar. The webinar will be recorded and posted along with briefing materials to the COR CV Pilot website.

The THEA Team will employ a comparative approach to performance measure development. The team will deliver a ConOps that includes quantitative performance measures in four categories: safety, mobility, environment, and public agency efficiency. These performance measures will be outlined in the Performance Measurement and Evaluation Support Plan. The ConOps will identify a set of proposed applications to be deployed in support of enhancing operational practice. Existing operational practices will be benchmarked and referenced in the evaluation of the deployed applications in regard to enhanced practices. Please refer to the performance management section (task 5) of Volume 1, Part 1 and Volume 1, Part 3 for more details.
A key component in the concept of operations for the Connected Vehicle Pilot Deployment Plan is a comprehensive treatment of how to deal with privacy and security issues. These topics will be addressed in a Privacy and Security Management Operating Concept. Several members of the THEA team bring extensive experience with the implications of both privacy and security considerations in the connected vehicle environment.

The THEA team understands the critical nature of maintaining privacy for any individuals participating in the connected vehicle system. Although the decisions to include personally identifiable information (PII) have not yet been made for all applications, we recognize that some may require such info on an opt-in basis. Even if no PII is collected, users must be able to trust that no tracking or identifying individuals will be conducted through data manipulation or analysis. The current security credential management system design (SCMS) includes protections against traceability, and the implementation of various internal physical, technical and organizational controls will provide for additional protections. For applications that may require PII, proper protection and handling of such information must be ensured. Privacy protection will be a cross-cutting theme throughout the development Phase 1 and beyond. During development of the privacy operational concept key concepts such as creating and applying sanitization algorithms to remove PII from the data obtained from the pilot deployment, data combined from multiple public and/or private data sources, as well as potential PII from archived data used during performance measurement. The THEA team understands the standard administrative procedures for ensuring safe storage of, limited usage of, and restricted access to, data with PII, and those that may lead to the discovery of PII.

With regard to operations, THEA will ensure that its specification of policies, administrative and technical controls, and database management tools and approaches include clarity on the following principles in maintaining the highest levels of privacy protection possible, based on the needs of the system and applications:

• Transparency
• Individual Participation and Redress
• Purpose Specification
• Data Minimization
• Use Limitation
• Data Quality and Integrity

The program will follow the Common Criteria methodology, an ISO standard, to complete an analysis of needs and develop recommendations for a security standard. The methodology includes analyzing threats, assumptions, policies, objectives, and developing security functional requirements to mitigate threats and ensure confidentiality, availability, integrity, authenticity and non-repudiation of transmitted data. THEA will leverage team member expertise in this domain to determine which requirements can be fulfilled based on the prototype SCMS and align these requirements to each SCMS functional component. Using the Connected Vehicle Reference Implementation Architecture (CVRIA), the THEA team will determine the roles, processes, data flows, physical components, and communications protocols necessary for privacy and security operations utilizing the SCMS prototype. The team will concurrently use the SET-IT tool to complete project architecture diagrams and definitions at all layers and functional components along with an inclusive Privacy and Security Management Operational Concept aligning requirements to necessary aspects of the CVRIA.
The Security Management Operational Concept will include clear direction on how to approach ensuring physical security at the vehicle and roadside infrastructure level. Several current hardware security standards exist for ensuring against tampering of physical devices, many of which may be applicable to DSRC devices integrated or added on to vehicles. In addition, maintaining strong internal organizational controls, whether at the technical, legal, administrative, or personnel levels should be developed and included in this Concept in order to provide as robust a security environment as possible. Tools to monitor, measure, and track security elements at all levels of the CV system will also be specified in the Security Management Operational Concept.

Task 4 – Safety Management Plan

The THEA Team places the highest regard on safety during any project. The special circumstances of this pilot deployment adds atypical and complex issues in regards to public safety and the team will exert the necessary effort to mitigate the associated risks. HNTB Corporation, THEA’s GEC, will lead the creation of the safety management plan as a companion document to the ConOps. As this document and its application are critical to the success of the pilot through all phases, other key partners will provide input to this document, bringing extensive experience not only with safety considerations on roadway and transit projects, but also in the connected vehicle environment.

The safety management plan develops a set of safety scenarios for the applications and technologies of the pilot deployment. These safety scenarios include an evaluation of potential impacts and the mitigating benefits of fail-safe or other appropriate actions for the applications offered in this pilot program. A set of safety needs will be derived from this scenario-based analysis. The safety management plan will identify levels of safety risk associated with the pilot deployment by adopting or adapting standard automotive safety practices for production, such as ISO 26262 and Automotive Safety Integrity Level (ASIL) hazard analysis and risk assessment, but also by adhering to equipment installation safety standards as prescribed by OSHA, Hillsborough Area Regional Transit, Florida Department of Transportation and THEA.

During the ASIL Decomposition exercise on the safety pilot model deployment, no ASIL hazard events were identified. Consequently, it is anticipated that this project may result in a similar conclusion. Nevertheless, our team will conduct the analysis to determine if such risks are present, and we will deal with any such risks according to ISO 26262 and the ASIL process or a derivation thereof.

The test conductor will perform an Automotive Safety Integrity Level (ASIL) style of analysis or develop appropriate measures using system engineering and project management principles. These will include bench and field testing in isolated environments and pre-pilot dry runs, among others. In this way safety testing and risk management may lead to safe testing in the field in the pilot program.

Safety issues to explore are use of fail-safe design, fault-tolerant design, redundancy design, problems that could arise from latency delays in data transmission and processing in real-time field tests, and other issues. Given the extremely dynamic environment of roadway traffic, particularly the diversity and complexity of electronics that will augment driver behavior logistics, every effort will be made to anticipate the safety needs of the test participants and the traveling public.

A draft safety management plan will be prepared to evaluate each application for ASIL decomposition. This draft will be submitted to COR for review and THEA will revise the document in response to COR’s comments for final revision.
Task 5 – Performance Measurement and Evaluation Support

The THEA team’s intimate knowledge and understanding of Connected Vehicle Applications, coupled with our proven experience in conducting performance measurement and evaluation of local, state and USDOT programs – especially those that are heavily engaged in connected vehicle research – allow us to bring the perfect mix of experience and expertise necessary to successfully carry out this task.

The THEA team will develop a comprehensive Performance Measurement Plan that will capture all the key data elements from the deployment to help evaluate performance of the deployment in targeted areas. All critical performance measures included in the Plan will be built from the information included in the ConOps, as well as relevant inputs from earlier project Phases. Target metrics will be developed and vetted in coordination with the necessary stakeholders to generate a final set of performance measures that meet the independent evaluation needs. Key items for consideration during development of the Performance Measurement Plan include:

- Deployment impact hypotheses
- Evaluation criteria and scaling
- Timing, phasing and updating
- Mix of qualitative and quantitative measures
- Stakeholder segmentation and perceptions
- Evolution of new data sources
- Data quality and granularity versus cost
- Verification of measures and targets
- Future refinement of the deployment goals

The plan will outline the key questions to be addressed and resolved with conclusions from the evaluation efforts. Benefit-cost computations will be at the core of the analysis and it will address a number of the questions below.

- What are the overall impacts of the deployment? What performance measures or indicators best address the overall impacts?
- Has the deployment been able to realize its investments effectively? What is the criterion for a “very good” return on investment?
- What is the value of the deployment in the context of the planned level of investment through the projected end of the deployment?
- Can a clear causal link be made between a significant portion of the intended benefits and the actual impacts of the deployment?

The Plan will outline practical strategies and methods to address these issues and to provide credible and understandable conclusions. The Plan will detail documenting data sets on a regular basis (daily, weekly and monthly) depending on the type and nature of the performance measure. It will clearly define the baseline metrics and targets to be achieved to help determine how effective the CV pilot deployments have been. The plan will include a proposed protocol for recording actions taken by key deployment participants. The THEA team understands the need to train system users and test participants on the new technology, then assess how different training and actions that reflect the compliance of test participants affect the overall performance based on the implementation of the new technology. It will include methodologies to train test participants and familiarize them with steps required in order to record their actions in a way that strengthens the linkage between actions taken and changes in measured performance in the transportation system.
The THEA team has extensive familiarity with translating performance measures into a data collection approach and requirements. Key to properly assessing the CV pilot deployments is the development and implementation of a thorough and meticulous data collection approach for baseline data and post-application deployment data, whether through time series “before and after” approaches, or through control and treatment groups operating simultaneously.

The team’s analysis, modeling and simulation (AMS) approach will include the pilot deployment development and the implementation of an approach to generate system performance. The AMS system will serve as a virtual computer-based environment in a laboratory setting to facilitate detailed modeling/analysis. The modeling and simulation portion of this plan will detail the set of inputs needed for a particular software tool representing the proposed Pilot deployment area. Please refer to Volume 1, Part 3 for more information on AMS and performance measurement during deployment.

The team will identify, evaluate and mitigate system-wide impacts of individual expected confounding factors when applied in a connected environment by using statistical analysis, modeling and simulation techniques. Several tools will be needed in order to evaluate confounding factors and their impact on performance measurement. Team member Booz Allen Hamilton (BAH) has developed and integrated multiple tools including (1) Prediction Engine (2) Communications Emulator (3) Scenario Generator (4) Systems Manager Emulator and (5) Performance Data Capture and Storage.

These tools and methodologies will be used to conduct modeling and simulation of system generated scenarios to evaluate the selected CV applications and determine if the confounding factors impact the benefits. Benefits are assessed by modeling the applications and evaluating them in a simulated connected vehicle setting. The THEA team will identify the applications; prioritize them for modeling; perform benefit-cost analysis; and field test each application. Thorough risk assessment for modeling is needed prior to modeling each CV application.

The THEA team recognizes that a robust data sharing framework is critical to measuring performance on a program level. It will be essential to accurately report and share system performance data (including data format, data source, data definitions and action logs) all while maintaining key privacy protections identified in the Privacy Operational Concept. THEA will share the collected data openly on the Research Data Exchange.

Task 6 – Pilot Deployment System Requirements

The THEA team will develop a System Requirements Specification (SyRS) Document based on the COR-approved ConOps and following the guidance in IEEE Standard 1233-1998. We are very familiar with this process and use it routinely for ITS projects and have experience in developing SyRS for connected vehicle applications.

The identification and inclusion of stakeholders is important to developing good system requirements. The Tampa Bay Regional ITS Architecture will be referenced as well in determining requirements, especially to ensure that interrelated stakeholder interests are all-inclusive. As stated earlier in Section 1.3, a register of stakeholders will be maintained by the PML and will be updated as the concept is refined to include potential new stakeholders with an interest in the project.

THEA will provide a Requirements Traceability and Verification Matrix, tracing requirements back to needs defined in the ConOps and providing a documentation process for verification. This matrix will be expanded during Phase 2 to provide forward traceability to design specifications, verification/test plans, operations, and evaluation support activities.
The requirements analysis will include:

- Eliciting requirements: stakeholder workshops will be employed
- Analyzing requirements: determining whether the stated requirements are clear, complete, consistent and unambiguous, or resolving any apparent conflicts
- Recording requirements: requirements documented in various forms, including a summary list of process specifications
- Documenting how each requirement will be verified as having been met, i.e., inspection, testing, vendor specification, etc.

Interface requirements will include identification of relevant standards and that all stakeholders’ interests are represented at every level. Some of the biggest problems in systems development can arise at the interface level. In the pilot deployment, interfaces exist between agencies, between equipment components, communications, applications and software, systems and subsystems, and manual operations by drivers. Interface requirements will be detailed in Interface Control Documents (ICD), system/software design documents, architectures and other documents.

Performance requirements will be developed across all identified functions and characterized in terms of the degree of certainty in their estimate, the degree of criticality to system success, and their relationship to other requirements. Performance measures for equipment, local traffic at intersections and area-wide flows will be evaluated according to performance requirements developed by stakeholders for traffic and equipment analysis for the CV applications. Performance measures related to driver preferences and attitudes toward such applications may be applied through survey methods.

The applications in this CV pilot program are heavily data driven on a number of levels, including data from sensors, RSEs, in-vehicle equipment and driver interfaces, among others. Data and data sharing requirements will be developed to ensure the continuity of data flows and to avoid problems with bandwidth, data latency, and so on. The Tampa Bay ITS Regional Architecture will be resourced and updated as necessary, pertaining to data and data-sharing requirements.

THEA will assemble a preliminary SyRS Stakeholder Review Panel from the Stakeholder Registry described in Task 1.3. A preliminary roster will be submitted for COR review. Stakeholder SyRS Review Panel Roster revisions will be made and the procedure repeated according to COR as necessary until COR verifies acceptance.

THEA will schedule and conduct a SyRS walkthrough, per IEEE Standard 1028, of the revised report. THEA will arrange with COR to conduct an in-person meeting in Washington, DC in a USDOT-designated facility that supports webinar functions. We will prepare walkthrough materials for review (i.e., workbook) and a presentation. Key THEA team members associated with the SyRS will attend and present in person. COR and participant comments will be noted for resolution. A resolution report will be prepared for all comments received. The THEA draft walkthrough comment resolution report revisions will be sent to COR for acceptance. Approval of all comment resolutions is necessary before the revised report is considered final.

**Task 7 – Application Deployment Plan**

The application deployment plan will build on the system requirements and describe the additional functionality and performance elements required to further develop and integrate applications for use within the pilot deployment in order to address the transportation issues identified in the problem statement.

Each identified application will be assessed on the amount of development work required in Phase 2, both in terms of schedule and cost.
The application deployment plan will identify the expected open source software expected from and/or intended for posting on the Open Source Application Development Portal (OSADP). All the tools, algorithms and code developed through the project will be posted on the OSADP. The team will ensure the compliance of all deliverables as open data (under the Creative Commons Attribution-ShareAlike 3.0 Unported license) and open-source (under the Apache 2.0 license) guidelines.

The team will deliver the final documents to USDOT after a successful compliance check. We will submit software developed under this project under the terms of open data and open source and collaborate with the OSADP contractor to ensure compliance with documentation guidelines. The team will address all comments and concerns raised by USDOT representatives regarding missing, erroneous, and incomplete elements. The team will transfer all the cleaned data, along with the documentation, to the RDE while abiding by the terms of use of the RDE website.

Task 8 – Human Use Approval

This project must comply with federal regulations contained in 49 CFR Part 11 regarding any testing work that involves the use of human subjects. The federal regulations are intended to protect the rights and safety of individuals from the public at large who participate in testing for research purposes. To comply with the federal regulations, a proposed test plan must be submitted to an established institutional review board (IRB) for examination and approval prior to conducting any test with human subjects. Team Member HNTB will lead this task, working with BAH and Center for Urban Transportation Research at the University of South Florida (CUTR) to obtain Institutional Review Board (IRB) approval for human use of the proposed pilot applications. The team will use an accredited IRB with experience in transportation technology.

We will submit to the IRB: the ConOps, Security Management Plan, and Safety Management Plan along with information on all pilot applications to be implemented to the IRB for analysis. We will identify any applications previously evaluated and approved under an earlier pilot to facilitate an accelerated review of those applications. We will hold regularly scheduled review coordination meetings with the IRB to ensure any updates from other tasks are communicated to the IRB as well as providing response and resolution of issues/concerns identified in feedback from the IRB to the team. The THEA team will be responsible for acquiring IRB approval for the proposed applications in order for them to be included in Phases 2 and 3. Upon IRB approval, the team will prepare a draft summary of the IRB’s Human Use Approval. All COR comments will be resolved.

Phase 3 of the pilot will provide an opportunity for Human Use outcomes to be observed, collected and reported in support of USDOT’s Human Factors Research Plan tracks 2-5.

• **Track 2**: Develop and evaluate performance metrics for distraction mitigation. By monitoring new technology interfaces and developing best practices, objective test procedures can be developed to assess distraction and usability factors in production vehicles and portable nomadic technologies.

• **Track 3**: Produce an integration strategy that allows nomadic systems to be functionally integrated with vehicle-based systems to optimize the driver-vehicle interface. Integration can reduce interface complexity and the occurrence of multitasking.

• **Track 4**: Develop qualified exposure testing through field experiments that determine the long-term safety impacts of crash warning technologies and their effects on driver behavior.

• **Track 5**: Conduct strategic stakeholder outreach to identify requirements, information needs and usability issues toward the goal of public acceptance.
Task 9 – Participant Training & Stakeholder Education Plan

The THEA team will prepare a high level plan for the recruitment and training of all stakeholders, travelers, test vehicle drivers and other personnel participating in the pilot. One of the differentiators of THEA’s pilot is that it not only involves designated vehicles/drivers with connected vehicles but also allows for the traveling public to participate as well. The team’s extensive public awareness experience with these types of programs will allow them to interface with travelers in general prior to deployment, thus facilitating an education and training program for those participating.

In order to fully capture the impact of the pilot on all stakeholders including the traveling public, we will include in our training and education plan, a process to identify, engage, educate and solicit feedback from a relevant cross section of participants early in the process. This will include not only the main focus on training instructors, supervisory staff and maintenance staff, but also include webinars, etc., for involving the traveling public in what to expect, how to take advantage of the benefits and provide feedback to the team for incorporation into the full life cycle system engineering process.

The Participant Training & Stakeholder Education Plan will be written and reviewed to ensure consistency with the outcomes and plans associated with task 4, Safety Management Plan and task 8, Human Use Approval Plan. The team will prepare a draft participant training and stakeholder education plan for COR review. Upon receipt of comments from the COR, the team will prepared a revised version addressing the COR comments. Only after the COR has accepted and approved all comment resolutions will the plan be considered final.

Task 10 – Partnership Coordination & Finalization

THEA is fortunate to have a diverse array of available partners for this pilot. Few, if any, other teams could bundle together in one pilot: A standalone reversible express lanes (REL) that can be closed for deployment, testing and operation of a pilot; a large military community that traverses the pilot zone on a daily and predictable basis, thus allowing for a large pool of participants who can be issued CV onboard units to place in their vehicles during the pilot; a bus rapid transit system that connects communities on both ends of the REL and feeds corridors identified for management in the pilot; a cruise port and high volume shipping port with a direct connector to the REL; a longstanding history of interagency coordination and partnering; several tech savvy private entities offering last mile transportation interfaces such as taxi, airport transfers, bike share programs, trolley service, smart parking etc.; CUTR at University of South Florida (USF).

This team is well ahead of the curve with forging key partnerships: many of the required have been in place for years. The City of Tampa (COT), Hillsborough Area Regional Transit (HART), MacDill Air Force Base (MAFB) and Tampa Downtown Partnership have already signed letters of support for this pilot and are prepared to sign formal MOUs upon award. The close relationship between THEA and the COT will allow for a smooth integration of the Advanced Traffic Management System (ATMS) component of the pilot.

Several other stakeholders have already been identified and have been very welcoming of the proposed applications. After award, all stakeholders will be included in webinars, meetings and presentations to ensure the number and appropriate partners are involved. During this process, MOUs will be developed and executed with all participants and verify agreement with concepts, objectives and all institutional and financial agreements necessary to deploy and operate the pilot. A communications matrix will be established to facilitate all parties staying informed and understanding each other’s roles as well as how to disseminate project info and feedback to the correct entity.
THEA will develop a draft partnership status summary for submittal to the COR. Upon receipt of comments from the COR, we will submit a revised status summary. Only after all COR comment resolutions have been accepted and approved will the summary be considered final.

Task 11 – Outreach Plan

As the nation prepares to successfully deploy connected vehicles, an essential part of this initiative is providing factual, relevant and timely information to a wide variety of stakeholders. The outreach plan will articulate the media strategy for local and national press, media coordination with the USDOT, web and social media presence, trade show strategy and budgets, local outreach strategy, initiatives to increase community awareness and a crisis communications plan. The outreach plan will propose how to interact with other USDOT CV pilot deployment efforts and how we will accommodate site visits and demonstrations. The plan will detail the public relations and marketing activities that will occur through the creation of talking points, briefing materials, and articles for the news media, news releases, fact sheets, electronic media kits, photos, videos, and trade show events.

The plan will clearly articulate which trade shows, demonstrations, news conferences and public meetings are recommended, the exact location, and costs associated with each event. This will provide the information needed by USDOT to determine the return on investment for each outreach effort proposed. The plan will also detail the best use of man-hours over the 38 months of Phases 2 and 3 to provide consistent, on-going outreach support.

Global-5 President & CEO Mary Hamill, APR, will serve as the outreach lead. Global-5 Senior PIO Chris Patton is the proposed lead spokesperson. More information about Mary and Chris can be found in Volume 1, Part 2.

Regarding media relations, TV stations, newspapers and radio stations all want digital assets to tell their stories on air and online—videos, infographics, and photos. Reporters at the local level want to know how connected vehicles will specifically change their city and region. They also want to understand the nature of the technologies and the status of the national program. By developing electronic media kits that include timely sound-bites from USDOT spokespeople and experts, we are able to provide the expected level of support at the local level and the USDOT perspective. The team will provide key message development and on-camera media training in person and via video conference. This provides consistent and timely message coordination.

We propose regularly scheduled meetings to keep outreach efforts well-coordinated internal to the project team, partners/stakeholders and with USDOT. The team will prepare the agenda for each meeting and will follow up with action items to ensure all deliverables are accomplished in a timely manner.

The project website and on-going social media will be the face of the project to the world. The team’s in-house web, graphic design, photography and HD video production facilities provide the resources needed to keep content fresh, relevant, and easy to understand while focusing on the benefits of connected vehicles. The website would include the latest news coverage and a robust newsroom section offering expert sound-bites, b-roll, photos, and infographics for the media to use when covering the story. Social media is rapidly evolving, and each agency involved in this effort has its own social media policies. We will provide timely and visual social content that is appropriate for all partners, recognizing and respecting the policies of each agency.

This team specializes in outreach to the ITS community and has a full calendar of trade show conferences and events ready to propose. We regularly attend ITS America Annual Meetings, World Congresses, ITS Florida conferences, and many other engineering, automotive, transit, freight and safety events. We will propose the conferences that reach the right target audiences at the right time with the right message. To maximize
opportunities at these events, we propose positioning USDOT experts as speakers, panelists and moderators. There may be the opportunity for a demonstration at the trade show as well. Our media relations efforts will support those presenting, demonstrating and exhibiting. A news release and electronic media kit will be developed. Video and photos will be taken of the exhibit, and the expert spokespeople to be used on the project website, in social media and in other outreach efforts.

By nature, people are leery of change. Successful programs engage in local outreach efforts early. Early adopters can see and understand all the safety and efficiency provided by connected vehicle advancements, but many others will remain skeptical of the benefits or will focus on privacy concerns. The best way to overcome mis-perceptions and build a broad base of factual understanding is working with a variety of local stakeholders. This creates a well-informed group of policy makers, citizens and media on the local level that then become ambassadors and champions, helping spread the CV story throughout the region. The outreach plan and editorial calendar will clearly articulate the briefings, demonstrations, news conferences and media events that will be planned at the local level. These activities will focus on the MPO to reach the elected officials most engaged in transportation policy-making along with other local organizations. This comprehensive and sustained approach will result in a broad group of well-informed stakeholders at the local level.

We may also engage the media in helping us recruit drivers for our connected vehicle pilot program. The project website will be developed with this stage of the pilot in mind and will make it easy for the local community to learn about the project and to qualify to participate in it. We will establish clear guidelines for participants and target the groups that are best to involve in a pilot.

One of the chapters of our outreach plan will be devoted to our crisis communications plan. The THEA team will detail a protocol for identifying and swiftly responding to a crisis. While not all circumstances can be anticipated, our plan will cover issues that could arise from a crash or injuries involving a pilot program vehicle or participant, local protesters that may seek to undermine the advancement of technology, or natural disasters such as tropical storms, hurricanes, wildfires, sinkholes and other "acts of God" that can have an adverse effect on a pilot program resulting in damages to equipment and a setback to the timeline. Our crisis communications plan will establish clear protocols but will also remain flexible and adaptable to a variety of situations which may occur over the life of the pilot. The most important component of our crisis communications plan is what we refer to daily as "crisis avoidance." This section will be authored by Chris Patton; a FEMA-trained and certified Advanced Public Information Officer. Chris has authored numerous crisis communications plans, including the one for Florida's largest infrastructure project, the $2.3 billion I-4 Ultimate construction project.

Coordinating and interacting with other pilot programs accelerates progress for everyone involved, especially American taxpayers who stand to experience the benefits of connected vehicle deployment. Lessons learned and best practices from our pilot can be shared with other pilots on a regular basis so we are all advancing together. When we are developing our conference/trade show calendar, we can coordinate with other pilots to determine if a working group could be held before or after conferences that all groups are attending. Face-to-face communication is the best approach to problem solving.

Seeing is believing, and the most effective part of outreach for the pilot program will be site visits and demonstrations. These well planned events will be targeted for the right audiences who will hear the right message at the right time. As we move into pilot deployment, we'll be showcasing our demonstrations to a wide variety of stakeholder groups. Demos that include the media will also include development and distribution of a news release and electronic media kit. Our outreach lead and lead spokesperson will always be present for these high profile demonstrations and will bring additional personnel to assist with set up, sign-in sheets, name tags, and other needs.
To provide consistent messaging, a brand and tagline will be developed for the pilot program that will be used for all outreach and marketing materials. A unique brand will provide a strong identity for the pilot and at the same time will clearly position it as a joint effort of the USDOT and local agency.

Every outreach plan is a living document. Development of the plan will be a collaborative effort with USDOT and the project team. We will clearly articulate each activity recommended, the personnel that will be assigned, and the level of support that will be provided for each activity. USDOT will know exactly who is doing what and when.

**Task 12 – Comprehensive Pilot Deployment (CPD) Plan**

The stated objectives of this contract is to develop an innovative and synergistic connected vehicle pilot deployment concept, to build partnerships among stakeholders, and to prepare a comprehensive pilot deployment plan that reduces technical, institutional and financial risk.

The THEA team will develop a CPD plan that results in a deployment that is needs-driven, observable, measurable, and impactful while being on time and within budget. We will start working on the CPD plan in the ninth month of Phase 1, but each task element leading up to that point will be examined for how it integrates with the overall deployment plan during work on Tasks 2-11. This will be accomplished with task constructability/feasibility reviews by team members with extensive experience in deploying ATMS/ITS, CV Pilots and other technology projects.

The plan will summarize our overall pilot deployment concept and expected outcomes. The CPD will cover the following topics, at a minimum, based on all of the materials and deliverables prepared in previous tasks 2 through 11.

- Tying together the CV concepts, performance measures and applications
- Estimation of vehicles, participants, mobile devices, roadside and back-end infrastructure
- Development of methods and approaches for conducting the modeling and simulation, lab and field tests; data collection, assessing impacts and evaluation
- Implementation of privacy and security
- Coordination with RDE and OSADP
- Deployment of Communications and PNT (positioning, navigation and timing) solutions

The CPD will also discuss the necessary approvals required for any equipment and hardware installations including DSRC antennae that must follow certain federal/state/local regulations. The CPD will include, at a minimum, the following sections:

- Pilot Deployment Site Map
- Phase 2 and Phase 3 Pilot Site Schedule
- Phase 2 and Phase 3 Pilot Site Cost Estimate
- Site Installation/Deployment Schedule
- We will deliver Draft and Final versions of the CPD Plan, and conduct a public webinar to walk through our Deployment Plan.
Task 13 – Deployment Readiness Summary

We understand the purpose of the Deployment Readiness Summary (DRS) is to make the case that we have satisfied all of the required elements for Phase 1, and that we are in a position to respond to an assistance agreement funding the design, build, test, and operation of the proposed pilot deployment in Phases 2 and 3.

The required elements of the Deployment Readiness Summary include:
• Completion of Tasks 1-12 deliverables, finalized with COR comments. Monthly reports will remain ongoing beyond this milestone but all to date will be included in this summary.
• Con Ops has been validated as meeting all required elements.
• The Teaming framework is in place with all agreements signed including:
  • Governance agreements if needed, associated with coordinated system management.
  • Financial agreements signed by all parties involved in remunerative transfers.
• Clear Pilot Deployment Scope Definition, including: geographic boundaries, number of vehicles, devices and roadside equipment.
• Feasibility assessment covering acquisition of key technologies and assets in volumes per the planned effort.
• Clear plan for operation and maintenance during phase 3, including roles and responsibilities of all partners.

When the THEA team has completed deliverables for tasks 1-12, we will conduct a Deployment Readiness Summary Briefing (DRSB) for the COR in Washington, DC. In this briefing, we will document, demonstrate and state our case that all required elements have been met and that we are ready to proceed to an agreement for funding of Phases 2 and 3. THEA understands that some sites may be selected for CV certification and/or interoperability testing as part of the USDOT’s separate, but related Next Generation CV Certification. Given the differentiators of our site and considering several of our team members are OmniAir members, THEA welcomes the possibility of being selected for this very important activity.

Upon completion of the DRSB the THEA team will receive and incorporate feedback from the COR into the creation of a draft version Deployment Readiness Summary. This draft will be submitted to the COR for review and comment. All comments from the COR must be addressed in the final DRS. Only after all comment resolutions have been accepted and approved by the COR will the DSR be considered final.
Figure 2-1 Organizational Chart

**THEA EXECUTIVE DIRECTOR**
Joe Waggoner (CDL)

**THEA PROGRAM MANAGER**
Bob Frey

**PARTNERS**
City of Tampa
Hillsborough Area Region Transit
Tampa Downtown Partnership

**PROGRAM MANAGEMENT**
LEAD - TASK 1
Steven Johnson (H)

**OA/QC**
Jim Drapp, PE (H)

**SR. TECHNICAL ADVISOR**
Jim Barbaresso (H)

**QA/QC**
Jim Drapp, PE (H)

**SR. TECHNICAL ADVISOR**
Jim Barbaresso (H)

**TASK 2**
Pilot Deployment
CONOPS
LEAD
Steven Bahler, PE (H)
SUPPORT
THEA
HNTB
Siemens
Booz Allen Hamilton

**TASK 3**
Security Management Operating Concept
LEAD
Dominie Garcia (B)
SUPPORT
THEA
HNTB
Booz Allen Hamilton

**TASK 4**
Safety Management Plan
LEAD
Sara Beresheim (H)
SUPPORT
HNTB
Booz Allen Hamilton

**TASK 5**
Performance Measurement & Evaluation Support
LEAD
Abdul Pinjari (C)
SUPPORT
HNTB
Booz Allen Hamilton

**TASK 6**
Pilot Deployment Systems Requirements
LEAD
Jason JonMichael (H)
SUPPORT
Siemens
Booz Allen Hamilton

**TASK 7**
Application Deployment Plan
LEAD
Dwayne Henclewood (B)
SUPPORT
Siemens
Booz Allen Hamilton

**TASK 8**
Human Use Approval
LEAD
Victor Blue (H)
SUPPORT
HNTB
CUTR

**TASK 9**
Participant Training & Stakeholder Education Plan
LEAD
Mary Hamill (G)
SUPPORT
HNTB
Global-5

**TASK 10**
Partnership Coordination & Finalization
LEAD
Robert Frey (T)
SUPPORT
HNTB

**TASK 11**
Outreach Plan
LEAD
Susan Chrzan (T)
SUPPORT
HNTB
Global-5

**TASK 12**
Comprehensive Pilot Deployment Plan
LEAD
Jason JonMichael (H)
SUPPORT
HNTB
Siemens
Booz Allen Hamilton

**TASK 13**
Deployment Readiness Review
LEAD
Steve Bahler, PE (H)
SUPPORT
THEA
HNTB
Siemens
Booz Allen Hamilton

**Legend**
(T) THEA
(H) HNTB
(B) Booz Allen Hamilton
(C) CUTR
(G) Global-5

**Stakeholders**
City of Tampa
Hillsborough Area Regional Transit
MacDill Air Force Base
Hillsborough County
TECO Line Streetcar
Tampa Port Authority
Coast Bike Share Rentals
BMW/GEWI

**Vendors (Phase 2 & 3)**
Metro-Tech

Tampa Hillsborough Expressway Authority
## TASK LEAD & KEY SUPPORT STAFF MATRIX

<table>
<thead>
<tr>
<th>TASK</th>
<th>TASK LEAD</th>
<th>KEY SUPPORT STAFF</th>
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<tr>
<td>T.2 Pilot Deployment ConOps</td>
<td>(H) Stephen Bahler</td>
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<tr>
<td>T.3 Security Management Operating Concept</td>
<td>(B) Dominie Garcia</td>
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<td>T.4 Safety Management Plan</td>
<td>(H) Sara Beresheim</td>
<td></td>
</tr>
<tr>
<td>T.5 Perf. Measurement &amp; Evaluation Support</td>
<td>(C) Abdul Pinjari</td>
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<tr>
<td>T.6 Pilot Deployment System Requirements</td>
<td>(H) Jason JonMichael</td>
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</tr>
<tr>
<td>T.7 Application Deployment Plan</td>
<td>(B) Dwayne Henclewood</td>
<td></td>
</tr>
<tr>
<td>T.8 Human Use Approval</td>
<td>(H) Victor Blue</td>
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<tr>
<td>T.9 Participant Training &amp; Stakeholder Education</td>
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<td>T.13 Deployment Readiness Review</td>
<td>(H) Stephen Bahler</td>
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### LEGEND

- **(T)** THEA
- **(H)** HNTB
- **(B)** Booz Allen Hamilton
- **(S)** Siemens
- **(C)** CUTR
- **(G)** Global-5
- **(Ct)** City Of Tampa

*Support staff shown are representative and will be utilized as needed to achieve project goals*
Staffing Proposal

The THEA project team is comprised of an exceptional combination of partners, companies and agencies with the resources, skills and experience required to excel on this project. As the Offerer and lead agency, THEA has brought together a strong and distinctively qualified team to support their vision. Under THEA's leadership, this dynamic team will cooperatively leverage each member's talents to achieve a Connected Vehicle (CV) Pilot that benefits THEA, other local agencies, the City of Tampa and the Tampa Bay area at large while validating concepts and applications for widespread use on a national platform. The following content outlines the team, its structure, leadership, governance, expertise and other relevant attributes. Some team partners and initial stakeholders have already been identified, with others on the horizon. While some of these partners and stakeholders will have only minor roles during the concept development phase, their roles as participants and system operators will expand during subsequent phases of the program.

Team Organization

The team organization chart for Phase 1 is shown in Figure 2-1. Program leadership and task leads are shown. Resumes are provided for the three required positions – Program Management Lead, Concept Development Lead, and System Development Lead. Qualifications are included under the subsection on key personnel for task leads. The organization chart is supplemented by a Master Staffing Matrix (Table 2-1) to include other staff involved in this project by task, labor category and organization.

As shown in the organization chart, the team is led by THEA with HNTB as the General Engineering Consultant and extension of staff. THEA and HNTB offer a tightly integrated management team for this project and overall governance of the program. This existing contractual relationship enables flexibility in mobilizing resources, engaging subcontractors and augmenting staff. The current contract allows HNTB to subcontract services to other organizations without time-consuming procurement activities. This is a key advantage for overall support of the pilot deployment, but also serves to provide a mechanism for succession planning to quickly fill leadership positions, if necessary. Each of the THEA team member organizations were selected for their skills and experience. The qualifications of each of these organizations are summarized below.

THE TAMPA HILLSBOROUGH COUNTY EXPRESSWAY AUTHORITY
THEA owns and operates one of the most unique toll roads in the world, the Selmon Expressway Reversible Express Lanes (REL). The project opened to customers in July of 2006. It was the first of its kind to address urban congestion by combining the innovations of land-based concrete segmental bridges, reversible express lanes, cashless multi-lane open-road tolling and full electronic controls- all constructed within the existing right-of-way of Tampa’s Lee Roy Selmon Expressway. In addition to the Selmon Expressway, THEA also manages/ maintains the Brandon Parkway and several connector surface streets including Meridian Street, which will be used for this pilot.

THEA's Selmon Expressway is the only automated vehicle test bed in the United States to have facilitated real-time traffic tests in a closed course environment. Audi tested its Audi Connect A7 autonomous vehicle on the reversible express lanes of the Selmon Expressway in July 2014. The REL will be a key element of this Pilot.
Past Projects of Relevance

<table>
<thead>
<tr>
<th>PROJECT DESCRIPTION</th>
<th>THEA CONTACT</th>
<th>FHWA CONTACT</th>
<th>VALUE / DATES OF PERFORMANCE</th>
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<tbody>
<tr>
<td>Lee Roy Selmon Expressway</td>
<td>Joe Waggoner, Executive Director 813-272-6740</td>
<td></td>
<td>N/A / 2014</td>
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<tr>
<td>July 28, 2014 Audi AV Demonstration</td>
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<tr>
<td>THEA</td>
<td>FHWA Bus Toll Lanes Proof of Concept Study</td>
<td>Joe Waggoner, Executive Director 813-272-6740</td>
<td>Angela Jacobs, Value Pricing Pilot Program Manager, 202-366-0076</td>
</tr>
<tr>
<td>Lee Roy Selmon Expressway All Electronic Tolling Conversion</td>
<td>Joe Waggoner, Executive Director 813-272-6740</td>
<td></td>
<td>$13 million / 2009-2010</td>
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<tr>
<td>Lee Roy Selmon Expressway Enhanced Image Processor</td>
<td>Joe Waggoner, Executive Director 813-272-6740</td>
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<td>$2.1 million / 2012-2013</td>
</tr>
</tbody>
</table>

HNTB CORPORATION
HNTB is a leading provider of Connected Vehicle program technical support services to clients throughout the United States. Many state departments of transportation and toll authorities are developing plans that incorporate Connected Vehicle technologies and applications. This experience is directly relevant to the THEA CV Pilot Project. HNTB offers expertise in program management, systems engineering, ITS planning and systems integration, connected vehicle infrastructure design, advanced communications network design, stakeholder engagement and outreach, and traffic operations. HNTB’s extensive project experience includes:
• Safety Pilot Connected Vehicle Model Deployment
• AASHTO Near-Term V2I Transition and Phasing Analysis
• U.S. DOT ITS Strategic Plan
• U.S. DOT Connected Vehicle Test Bed Operations Management Support
• Michigan DOT Truck Parking Information and Management System
• Michigan DOT Connected Vehicle Support Services – 2010
• Michigan DOT Connected Vehicle Model Deployment - 2009
• Michigan DOT VII Model Deployment - 2008
• I-696/12 Mile Road/M-5 Connected Vehicle Test Bed, Farmington Hills and Novi, MI

BOOZ ALLEN HAMILTON
Booz Allen Hamilton brings a breadth and depth of Connected Vehicle experience, having worked closely with the USDOT and multiple stakeholders for several years on the research, development, and testing that set the foundation for the large-scale pilots. Booz Allen brings experts in the areas of Security Management Operating Concepts, performance measurement and evaluation of Connected Vehicle programs and technologies, and Connected Vehicle applications Concept of Operations (ConOps) and deployment plans. They have demonstrated experience with the U.S. DOT DMA program activities, the AASHTO Footprint Analysis, and various Connected Vehicle Test Bed activities.
• Harmonization Task Group 6, International. Security Policy Expert
• Development of DSRC Performance Measures, Phases I and II
• USDOT, FHWA, Near-Term V2I Transition and Phasing Analysis.
• USDOT, ITS JPO, Strategic Plan Support
• AASHTO Connected Vehicle Field Infrastructure Footprint Analysis
• FHWA Concept of Operations for Connected Vehicle Road-Weather Applications
• AASHTO Connected Vehicle Infrastructure Deployment Analysis
• USDOT, ITS JPO, Vehicle Infrastructure Integration Proof of Concept
• USDOT, FTA, Concept of Operations for Transit Connected Vehicle Applications
• USDOT, ITS JPO, Connected Vehicle Transactions Concept of Operations
• USDOT, FHWA, TMC Data Capture for Performance and Mobility Measures

CENTER FOR URBAN TRANSPORTATION RESEARCH (CUTR)
CUTR is a Tier I University Transportation Center (UTC) located in Tampa that has successfully competed in each cycle of UTC awards. Like HNTB, CUTR has a separate Connected Vehicle support contract with THEA and provides oversight on THEA’s CV projects. The Center will be a resource for the project team and project partners with its principal activity focused on Task 5. CUTR will act as the QA/QC agent for the development of the Performance Measurement Plan assuring that scientifically sound methodology, measurement criteria, data collection, data integrity and data presentation are all integral to the plan. The Center’s experience in econometric modeling will be available to assess the overall economic impacts of demonstrated deployments. CUTR will also work with HNTB to facilitate the IRB process, as the proposed IRB is a part of USF. CUTR is home to the National Bus Rapid Transit Institute (NBRTI) for which the following relevant transit technology project evaluations have been performed:


The Center also is engaged in active projects involving the performance measurement and evaluation of technology and driver behavior. Current relevant projects include:

• Interactions between Drivers and Pedestrian Features at Signalized Intersections
• Naturalistic Bicycling Behavior Pilot Study
• Pilot Study for Preventing Incorrect Turns at Highway-Rail
• Value Pricing Pilot Program
• Wrong Way Rectangular Rapid Flashing Beacon

GLOBAL-5
Global-5 Communications is the nation’s leading transportation communications firm and will be leading Tasks 9 and 11. Global-5 has more than a decade of experience managing project outreach activities for transportation clients including the FHWA, ITS Florida, and ITS America. The firm has also delivered nationwide training webinars and videos for the Federal Highway Administration Office of Innovation, working collaboratively with the National Highway Institute.

The firm has collaborated with THEA since 2009 as FDOT’s statewide marketing and media relations firm for the state’s 511 traffic information system. Global-5’s journalistic approach to story-telling results in proven and quantifiable traditional and social media successes and produces real understanding among stakeholders. The firm has in-house digital production facilities including branding, photography, graphic design, web design/development/hosting, multiple HD video camera and lighting packages, and an HD video production green screen studio and edit suite. Global-5 is an FDOT certified DBE and SBE and a woman owned small business.
Global-5 has won the three highest awards in the nation for its marketing and media relations successes for the FDOT 511 Traffic Information System. The firm was twice named the Best of ITS Outreach winner by ITS America (in 2014 and 2007) and was awarded the Public Relations Society of America’s Silver Anvil award in 2013 for producing quantifiable results for FDOT’s 511 system.

**SIEMENS**

As a world leader in Intelligent Traffic Solutions, Siemens Industry, Intelligent Traffic Systems is uniquely qualified to assist THEA in developing and implementing a connected vehicle solution. Siemens is a member of the U.S. Department of Transportation Research and Innovative Technology Administration Affiliated Test Beds with Siemens employee and innovator, Dave Miller, sitting on the ITE Connected Vehicle Task Force. Siemens will provide support to Tasks 1, 2 and 6, 7, 8, 9, 10, 11, 12, 13.

Siemens ITS has been in the forefront of connected vehicle technology and development for over 8 years and will continue to be an innovator in this field. Siemens works with government agencies to deliver solutions that meet their unique needs while committing to safety for the motoring public, quality to clients and to leading the way in innovation.

**Reference Projects**

- 2007 USDOT Connected Vehicle Test Bed in Oakland County Mi consisting of 75+ intersections broadcasting Signal Phase and Timing to Crash Avoidance Metrics Partnership test vehicles
- 2011 USDOT Connected Vehicle intersections on International Drive and Universal Drive in Orlando FL for ITSA World Congress
- 2012 USDOT Safety Pilot in Ann Arbor MI, consisting of Siemens central software and controllers communicating to 2,000 equipped vehicles, as well as interoperability demonstration with another controller manufacturer installed in 2012
- 2013 Adaptive signal control software application that constantly adjusts signal timing every 3 seconds based on approaching vehicles, while communicating signal countdown to vehicles
- 2014 USDOT Connected Vehicle corridors in front of Cobo Center for ITSA World Congress
- 2014 Memorandum of Agreement signed with USDOT as a Test Bed Affiliate with access to the Connected Vehicle test bed data warehouse to insure interoperability of new pilot deployments with the existing USDOT pilot deployments
- 2014 Co-Chair of the Society of Automotive Engineers J2735 harmonization effort between the US, UK and EU, including the Connected Vehicle pilot corridor between Rotterdam and Vienna and the Compass 4D test bed in the UK
Partners and Stakeholders

In addition to the team members who will actively participate in Phase 1, the overall THEA team includes a number of partners and key stakeholders. Each of these organizations offers resources – infrastructure or personnel – or will be impacted, directly or indirectly, by this project.

Partner organizations include:

- **City of Tampa (COT)** – COT controls traffic signals along arterial roads in the pilot area. Signal control strategies offered in this proposal will be implemented by COT.
- **Hillsborough Area Regional Transit (HART)** – HART currently offers express bus services along arterial roads in the corridor and on the Selmon REL. This offers an opportunity to deploy applications that support multimodal travel and Integrated Corridor Management (ICM).
- **Tampa Downtown Partnership**

Through the stakeholder engagement process, the THEA team will engage a number of stakeholders including, in addition to the above partners:

- **MacDill Air Force Base (MAFB)** – MAFB is home to many of the nation’s units that are key not only to our defense but also to the protection of critical national infrastructure. Each day, more than 17,000 personnel are reporting for duty; and the largest single housing location for these personnel in Brandon, FL at the east terminus of the Lee Roy Selmon REL. This captive pool of potential pilot participants could be issued V2I and or V2V onboard test units making MacDill a unique opportunity partner. MAFB is already working with THEA on a gate wait time/decision point DMS solution which could benefit from this pilot.
- **Florida Department of Transportation (District 7)** – FDOT District 7 hosts the Regional Traffic Management Center for the Tampa Bay Metropolitan Area. SunGuide systems will be the source of data for some of the applications described in this proposal.
- **TECO Line Streetcar** – This downtown trolley system provides last mile solutions to residents, visitors, students and special event participants.
- **Tampa Bay Port Authority (TPA)** – TPA is the largest deep water port in Florida and the 22nd busiest port in the nation. There is also an adjacent cruise port servicing multiple cruise lines. The I-4 Connector was recently built to accommodate commercial carrier traffic to/from the port, moving them off of surface streets. The close proximity of both port facilities makes them an ideal partner for this pilot.
- **Coast Bike Rentals** – a bike share rental business with automated pick up drop off locations throughout the entire pilot.
- **BMW/GEWI** – BMW and GEWI are vendor partners with extensive connected vehicle infrastructure development experience. With many new BMW vehicles already equipped and GEWI’s interface tools, this vendor team has the potential to participate in Phases 2 and 3.
- **Activity centers within the test bed corridors** - These activity centers include Amalie Arena, home of the Tampa Lightning and regular concert/show venue; University of Tampa, River Walk, Glaser Children’s Center, Channelside Entertainment District, Tampa Convention Center, Cruise Port, Florida Aquarium, Curtis Hixon Park, and several museums.
- **Other stakeholders will be identified and invited to participate in this project during the Concept of Operations development.**
Key Personnel
The THEA team includes the three required key personnel. Their resumes are appended to the end of this section.

JOE WAGGONER – CONCEPT DEVELOPMENT LEAD
With more than 35 years of experience in a variety of transportation modes, THEA Executive Director Joe Waggoner has overseen the agency’s transition to an independent, self-sustaining toll agency. During his tenure, he has implemented significant changes, including the agency assumption of roadway maintenance and operations, the conversion of the Selmon Highway to all-electronic tolling and assumption of toll operations, the elimination of a lease-purchase agreement with the Florida Department of Transportation, improved bond ratings and secured THEA’s first bond issuance as an independent toll authority. Each of these efforts provided enhanced performance and cost efficiencies. THEA’s jurisdictional authority was also expanded to provide toll agency services in counties adjacent to Hillsborough County. These accomplishments were driven by the goal of providing the best service possible for our customers and community. Prior to his role at THEA, Joe spent 28 years with the Maryland Department of Transportation in various roles that included highway and aviation planning and capital programs. He also spent seven years with Maryland Transportation Authority, which oversees Maryland toll facilities.

STEVE JOHNSON – PROGRAM MANAGEMENT LEAD
Steve Johnson is the HNTB Florida lead for CV/Tolling within the ITS group. He brings cross functional, technical project and program management experience spanning more than three decades. Steve has managed large concurrent projects including a single project involving 182 Department of Defense facilities in 23 countries with a value in excess of $100 million. The last 11 years have focused on ITS/ATMS and CV with successfully completed projects in every FDOT District as well in VA, NV and GA. He is proficient in service level agreements, negotiations, partnering facilitation, and project controls. Steve's primary technical skillset includes ITS/ATMS design and systems engineering / integration. Steve is a candidate for Connected Vehicle Professional I certification and sits for the exam in April. As the PML, Steve will also lead Task 1

JASON JONMICHAEL – SYSTEM DEVELOPMENT LEAD
Jason JonMichael has more than 23 years of specialized experience in Systems Engineering and Implementation and Transportation Technology Delivery. He brings national experience over a broad range of technology deployments. As an active Executive Board Member and past Chairman of the OmniAir Consortium, Jason brings a unique mix of Connected Vehicle technology, application, adoption and policy experience. His vast experience also includes traditional ITS, Integrated Corridor Management, Cooperative Systems, Information Technology (IT), Information Systems (IS), communications, systems engineering and integration, Geographic Information Systems (GIS), operations centers, data centers, remote and central systems, security systems, command and control, and database and web development, operations, and maintenance. Jason has been responsible for the full life-cycle of over 60 systems: planning, design, development, integration, approval and acceptance, and operations and maintenance. He is a national expert in Engineering Technology, Systems Engineering, Communications, and Connected Vehicle Technology (V2V, V2I, and V2X). He possesses a wide and in-depth field-proven knowledge of systems engineering having designed, deployed and integrated some of the most successful systems in the country.
Task Leaders

Other key personnel include the task leaders identified in Table 2-1, the Master Staffing Matrix. Bios for the remaining key staff are shown below:

Robert “Bob” Frey (THEA) As the overall agency program manager for the THEA Pilot, Bob will be actively involved in all aspects of the three phases and a main point of contact. Bob will also lead Task 10. He serves as the Planning Director for the Tampa Hillsborough Expressway Authority (THEA) and has more than 24 years of planning and operations experience working throughout Florida and the United States. As part of his duties, Bob is THEA’s project manager on their Connected Vehicle Technology (CVT) Initiative. THEA started this initiative in March 2013 and has three goals that all CVT projects must meet for them to be approved by THEA.

- Must advance the Technology
- As a Toll Road, all projects must provide value to THEA’s customers
- The projects must be local in Tampa and highlight our community

In the two years since starting the initiative, THEA has accomplished bringing the first State of Florida Automated Vehicle Summit to Tampa as a partner with FDOT, sponsored the University of South Florida’s Automated Vehicle Institute, joined the OST-R affiliated test bed program, had a demonstration project with Audi that included National television coverage with Governor Scott and sits on the Florida Department of Transportation Connected Vehicle Working Group. THEA’s planning focus has been to bring safer mobility choices to Tampa Bay using innovation and creativity to overcome transportation problems.

Bob holds a Masters of Public Policy degree from Baylor University, is a member of the American Institute of Certified Planners and a graduate of the International Bridge, Toll, and Tunnel Association (IBTTA) Leadership Academy.

Dominie Garcia, PhD (BAH). Dominie will lead the development of Task 3: Security Management Operating Concept. Dr. Garcia has been leading multiple projects for the U.S. DOT focused on developing designs for and analyzing policy implications of credential management and security systems for connected vehicles for several years. She has led teams that have worked closely with the technical design teams for the current SCMS design, developed performance measures for security needs for DSRC devices, and analyzed multiple areas that will be affected by the security needs and designs. Her recent work with the DOT Intelligent Transportation Systems Joint Program Office, leading a team to design and develop organizational and operational models to handle the certificate management functions of the Connected Vehicle served as significant areas of input for NHTSA’s rulemaking process.

Sara Beresheim, PE, PTOE (HNTB). Sara will lead Task 4: Safety Management Plan. She will also support Tasks 2, 5 and 6. Sara is fully qualified to lead the development of the Safety Management Plan. She has strong knowledge of ITS/ATMS systems design; operations and maintenance; systems specifications; scopes of services; integration; and incident management. Her background includes performance of many traffic and safety studies, field reviews, plans and report preparation, and quality assurance reviews. She has strong communication skills and is an effective presenter and facilitator of meetings and workshops. She will leverage the skills of other team members to support the ASIL decomposition process and to assess other safety risks on this project.

Abdul Pinjari, PhD (CUTR). Abdul, an Associate Professor in the Department of Civil and Environmental Engineering at the University of South Florida (USF) and a faculty affiliate with the Center for Urban Transportation Research (CUTR) at USF, will lead Task 5. His areas of expertise include multimodal...
transportation planning and modeling, activity-based travel demand microsimulation, passenger and freight
travel demand forecasting, travel behavior impacts of advanced automotive technology, modeling of household
vehicle ownership and technology adoption, travel survey methods, and statistical and econometric modeling
methods. Of particular interest to this project is the work that Abdul is currently conducting on understanding
the public perception of advanced automotive technologies, consumer adoption of autonomous vehicles, and
travel behavior impacts of advanced automotive technology.

**Ram Kandarpa (BAH).** Ram will lead Tasks 6 and 7 and support Tasks 3, 4, 5, 7, 12 and 13. Ram is a
program manager and senior transportation systems engineer with nearly 20 years of experience in ITS. For
the past 9 years, he has been deeply engaged in the planning, design, development, testing, and evaluation
of next-generation ITS technologies, services and applications that are specifically enabled via connected
vehicles. In particular, Ram leveraged his many years of experience in the highway, transit, freight, and
intermodal areas to develop, implement, and test public sector applications to improve safety, mobility and
environment.

**Victor Blue, PhD (HNTB).** Victor will serve as task leader for Task 8: Human Use Approval. He will also
support Tasks 4 and 5. Victor has served in many capacities throughout his career, including transportation
research analyst, engineer, and planner. He has advanced skills in the management of traffic studies, traffic
simulation and impact analysis, arterial design, travel demand forecasting, travel demand management, HOV
lane modeling, ITS planning and design and dynamic traffic assignment. He also offers excellent writing and
presentation skills. Victor will use his knowledge base and rapport with the transportation science academic
community to facilitate and document Human Use Approval with an accredited IRB.

**Mary Hamill (Global-5).** Mary will lead Tasks 9 and 11: Outreach. She is president, CEO and founder of
Global-5, Inc., the nation’s leading transportation communications firm. Global-5 specializes in the development
and implementation of integrated strategic communications plans and multimedia outreach campaigns that
improve mobility and safety. Mary provides executive oversight and quality control for all Global-5 projects
for FDOT Central Office and Districts, the Federal Highway Administration (FHWA), state departments of
transportation, transit agencies, tolling authorities, the Transportation Security Administration (TSA), AAA,
American Honda Motor Company, Mercedes Benz North America, and the nation’s leading transportation
infrastructure companies. Mary was the Communications and Outreach lead for the 2011 ITS World Congress
in Orlando, Florida.

**Stephen Bahler, PE (HNTB).** Steve Bahler is an Intelligent Transportation Systems (ITS) department
manager and a senior ITS project manager with HNTB. His 46 years of experience encompasses a broad
range of transportation program and project management, including ITS planning, highway, environmental
studies, urban freeway design, construction oversight, architecture and systems engineering for transportation
management centers (TMCs), freeways, arterials and transit and traveler information. In the past 10 years, he
has worked on TMC projects for the Florida and Kansas Departments of Transportation, as well as for local
agencies and authorities.

Steve began his career in the transportation industry at the Federal Highway Administration (FHWA) where
he started as a construction technician and worked through various positions to eventually serve as the traffic
management engineer. Steve will Lead Tasks 2 and 13. He will support tasks 4, 6 and 12.
Joe Waggoner, Jr.
Concept Development Lead

With more than 35 years of experience in a variety of transportation modes, THEA Executive Director Joe Waggoner has overseen the agency’s transition to an independent, self-sustaining toll agency. During his tenure, he has implemented significant changes, including the agency assumption of roadway maintenance and operations, the conversion of the Selmon Highway to all-electronic tolling and assumption of toll operations, the elimination of a lease-purchase agreement with the Florida Department of Transportation, improved bond ratings and secured THEA’s first bond issuance as an independent toll authority. Each of these efforts provided enhanced performance and cost efficiencies. THEA’s jurisdictional authority was also expanded to provide toll agency services in counties adjacent to Hillsborough County. These accomplishments were driven by the goal of providing the best service possible for our customers and community. Prior to his role at THEA, Joe spent 28 years with the Maryland Department of Transportation in various roles that included highway and aviation planning and capital programs. He also spent seven years with Maryland Transportation Authority, which oversees Maryland toll facilities. Looking to the future, THEA has developed a new concept to provide urban mobility by inviting transit into the tolling business. This concept, known as Bus Toll Lanes, combines the financial strengths of tolling and the people moving power of transit to create a sustainable/growable mobility solution to address urban congestion. In January of 2014, THEA became one of ten roadways approved by the U.S. Department of Transportation (USDOT) as a Test Bed for Automated Vehicle Technology. We are now pursuing a USDOT grant to implement connected-vehicle pilot project in partnership with our local transit agency and the City of Tampa.

Relevant project experience includes the following:

**Tampa-Hillsborough County Expressway Authority (THEA)** – Executive Director, August 2007 to present (17 full-time employees). THEA is a regional toll agency established under Florida State Statute. Responsible for managing the performance and oversight of all aspects of administrative, financial and planning duties for the operation of a public toll agency and its projects and programs; carrying out the Board’s policy and directives; ensuring public visibility in the implementation of all agency operations and articulating the vision and mission of the organization; maintaining liaison activities with legislative and executive policy makers of the city, county, state, peer agencies, community leaders,

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**Education**
Masters of Public Policy
University of Maryland, 2002

Executive Development Program
Maryland Department of Transportation, 1989
B.S., Geography and Environmental Planning
Towson University, 1977

**Professional Registrations**
International Bridge, Tunnel & Turnpike Association, Board of Directors
Hillsborough County Metropolitan Planning Association, Board of Directors
Hillsborough County Economic Development Council, Board of Directors
Greater Tampa Chamber of Commerce, Board of Directors
Conference of Minority Transportation Officials, Florida West Coast Chapter

**Years of Experience**
35

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**Firm**
Tampa Hillsborough Expressway Authority
bond rating agencies and other stakeholders; overseeing news releases and press conferences; giving
interviews with the media and public presentations; and ensuring the effective administration, management and
operation of the organization and agency infrastructure and the performance of all contractual services

Maryland Transportation Authority – Chief, Planning and Development, May 2004 to August
2007. Division of Capital Planning (24 full-time employees); Division of Strategic Development – (8 full-time
employees); Division of Engineering and Construction Management, and Division of Communications (80 full-
time employees)

Maryland Transportation Authority – Director, Division of Strategic Development (8 full-time
employees), November 2000 to May 2004; Strategic Planning, Real Estate Assets and Right-of-Way
Management, Revenue Projects on behalf of the Maryland Department of Transportation, Transportation
Public-Private Partnership Program (P3).

Maryland Department of Transportation – Assistant Director, Office of Planning and Capital
Programming (9 full-time employees); May 1989 to November 2000

Maryland Aviation Administration – Chief of Program Development (2 full-time employees), March
1985 to May 1989

Maryland State Highway Administration – Transportation Planner and Program Analyst, January
1980 to February 1985
Jason JonMichael
System Development Lead

Firm
HNTB Corporation

Education
B.S., Economics and Management
University of Georgia, 1998

Certifications & Training
Using the National ITS Architecture for Deployment (1999)
Fiber Optic Systems for Local and Wide Area Networks (1997)
Certified Fiber Optic Technician (1996)
Cisco Certified Network Associate (2004)

Professional Affiliations
OmniAir Consortium, Past Chairman of the Board, CIO
Construction Management-IT Committee, Transportation Research Board (TRB) of the National Academies
Institute of Electrical & Electronics Engineers (IEEE)
Institute of Transportation Engineers (ITE)
International Council of System Engineers (INCOSE)
International Engineering Consortium (IEC)
Council of Technology Advisors (CTA)

Years of Experience
23

Jason JonMichael has 23 years of specialized experience in systems engineering and implementation, and transportation technology delivery. He brings national experience over a broad range of technology deployments. As an active Executive Board Member and past Chairman of the OmniAir Consortium, he brings a unique mix of Connected Vehicle technology, application, adoption and policy experience. Jason’s is vast experience includes traditional intelligent transportation systems (ITS), integrated corridor management, cooperative systems, information technology, information systems, communications, systems engineering and integration, geographic information systems, operations centers, data centers, remote and central systems, security systems, command and control, and, operations, and maintenance. Jason has been responsible for the full life-cycle of more than 60 systems: planning, design, development, integration, approval and acceptance, and operations and maintenance. He possesses a wide and in-depth field-proven knowledge of systems engineering having designed, deployed and integrated some of the most successful systems in the country.

Relevant project experience includes the following:

Tampa Hillsborough Expressway Authority (THEA), Tampa, FL – As senior advisor, Jason assists the HNTB GEC project team in providing expertise in system and network operations and maintenance. Jason is currently providing support for THEA’s AV and CV related efforts.

GDOT Virtual Weigh-In-Motion Policing and Enforcement, Atlanta, GA – As senior project advisor, Jason assists the HNTB GEC project team, working in concert with GDOT’s Innovative Projects Division (IPD) in providing expertise in system planning and development for Georgia’s first best value design build – a statewide model deployment of Virtual WIM technologies and system operations. Jason is currently providing leadership in the areas of concept of operations, stakeholder coordination, MOU’s, and development of the functional and performance requirements of the system.

Executive Board Member, Past Chairman of the Board – OmniAir Consortium– As Chairman, Jason was responsible for the creation of the OmniAir Certification Services which is an independent, 3rd party certification services provider that will accredit and manage connected vehicle test centers, develop and/or credential tools, and issue OmniAir-Certified Certificates of compliance and interoperability. Recently, OmniAir
Jason JonMichael
System Development Lead

started the final round of Connected Vehicle Program Vehicle Awareness Device (VAD) testing in support of the USDOT Connected Vehicle Safety Pilot.

**MDOT IntelliDrive Demo Support, Michigan** – As project advisor, Jason assisted the HNTB project team in providing management, planning, design, integration, operation and support of the 2009 ITS Michigan Annual Meeting IntelliDrive Model Deployment in Novi, May 12-13, 2009 and the IntelliDrive Demonstration Session at the 2009 AASHTO Mississippi Valley Conference in Grand Rapids, July 15–17, 2009. The project was an enhancement of the applications developed during the previous year’s demonstration. New vehicle applications included roadside vehicle beacon, congestion pricing and vehicle miles traveled tolling.

**Support Services for MDOT IntelliDrive Program, MI** – Project advisor for this IntelliDrive program, a major initiative developed by the ITS section of the U.S. Department of Transportation. The IntelliDrive initiative will work toward deployment of advanced vehicle-vehicle and vehicle-infrastructure communications that could keep vehicles from leaving the road and enhance their safe movement through intersections. HNTB is responsible for design review. The main focus is to keep MDOT management informed of technology advancements and serve as a technical liaison to national IntelliDrive consortiums. The IntelliDrive group will publish presentations for MDOT management and will produce and publish a quarterly report for MDOT management relating to IntelliDrive.

**MDOT IntelliDrive Demo Support, MI** – As project advisor for applications and communications, Jason provided management, planning, design, integration, operation and support of the 2008 ITS Michigan Annual Meeting IntelliDrive Model Deployment in Novi. The project demonstrated that ready off-the-shelf technologies could be deployed for IntelliDrive. The project equipped two demonstration vehicles with laptop computers that communicated through a Motorola MotoMesh system to roadside radios and other vehicles. The laptop computer showed working applications such as traffic signal phase countdown, work zone notification, merge warning, bridge height warning, emergency vehicle warning, blue sign notification, parking availability and e-payment. A Virtual TMC was developed that demonstrated how real-time information from the demo vehicles’ OBDII bus could be utilized for probed details about the roadway network.

**MDOT IntelliDrive Test Bed, Farmington Hills, MI** – Communications lead for the design and build of the nation’s first ever vehicle infrastructure integration test bed. This system includes the installation of radio equipment on signal poles along 12-Mile Road and MDOT ITS facilities on the expressway. The radio equipment will enable equipped vehicles the ability to communicate with each other and with road side devices in a meshed ad hoc network. The network will transmit information about vehicles and travel conditions to enhance safety and mobility.
Steve Johnson

Program Management Lead

Firm
HNTB Corporation

Education
Coursework
Central Texas College, 1985

Professional Registrations
Traffic Engineering and Operations, University of Maryland
Building Construction Trades, James Rumsey Vocational Center
DOD/MILSPEC Communications Installer
Intelligent Traffic Systems, National Architecture Consortium for ITS Training and Education (CITE)
Advanced Maintenance of Traffic, FDOT
IMSA Traffic Signal Level I Certification
IMSA Traffic Signal Level II Certification

Years of Experience
30

Steve Johnson brings more than 30 years of experience as a technical project manager in information technology and telecommunications with an emphasis on intelligent transportation systems (ITS)/advanced traffic management systems (ATMS). His expertise includes project management, resource management, change management, quality control, and service-level agreements. His technical skills include ITS/ATMS, network engineering, systems integration, outside plant cable construction, premise wiring, traffic signal design and operation, and wireless networks, including over 300 miles of Fiber Optic network and ITS/ATMS Infrastructure. He has also provided CEI project administration for a major Managed Lanes project and over 200 signalized intersections.

Relevant project experience includes the following:

FREEWAY ITS
I-75 from CR 54 to SR 52, FDOT District 7, Tampa, FL – Project Manager for the design of nine miles of new ITS construction and integration. Provided design of the fiber optic communications network, IP scheme assignments and layer 2 Ethernet switch configuration and coordinated for integration into existing SunGuide Layer 3 network. Led design team in layout of ITS devices including, conduit/manhole system, power service points, sign structures, CCTV, DMS, RWIS, HAR, and MVDS.

ITS/Regional Traffic Management Center (RTMC), City of Tallahassee, Tallahassee, FL – ITS CEI project manager who provided acceptance testing and certification of new ITS elements including FOC, dynamic message sign (DMS), closed-circuit television (CCTV), MVDS, and road weather information systems (RWIS) including the integration of these elements into the new RTMC and video wall. Authored acceptance test plan documents and managed the testing and acceptance procedures.

ITS Power Distribution System Upgrade, FDOT District 4, Broward County, FL – Senior network engineer.

ITS Deployment along 1-75, 1-595 and 1-95, FDOT District 4, Broward County, FL – Senior network engineer and ITS project manager.

ITS System Manager Phase VII, FDOT District 2, Jacksonville, FL – Senior Network Engineer.
Steve Johnson  
Program Management Lead

**ITS System Manager Phase IX, FDOT District 2, Jacksonville, FL** – Senior Network Engineer.

**ITS Design Build I-395 and SR 826, FDOT District 6, Miami, FL** – Senior network engineer.

**RTMC Build Out, FDOT District 7, Tampa, FL** – Project manager for design, installation, and integration of the Tampa Bay SunGuide RTMC.

**Districtwide ITS Maintenance, FDOT District 7, Tampa, FL** – Project Manager

**I-95 ITS Deployment/I-95 from Miami Gardens to US 1, FDOT District 6, Miami, FL** – ITS Project Manager.

**TOLLS AND MANAGED LANES ITS**

**I-595 Express Lanes Concessionaire, I-595 Express, LLC, Fort Lauderdale, FL** – OCEI project administrator responsible for the ITS portion of the project that includes constructing reversible, variable toll lanes in the existing median of I-595 and providing ITS relocation and new ITS construction to facilitate operations and maintenance from the existing Florida Department of Transportation (FDOT) District Four RTMC.

**Toll System Refresh, Florida’s Turnpike Enterprise (FTE ), Statewide, FL** – Senior network

**I-95 Managed Lanes Phase I and Phase II, FDOT District 6, Miami, FL** – Senior network engineer.

**ADVANCED TRAFFIC MANAGEMENT SYSTEMS (ATMS)**

**Continuing Services ATMS/ITS, Pinellas County Public Works, Largo and Pinellas Park, FL** – Project Manager and Lead Designer

**Sarasota ATMS Phases I and II, Sarasota County Public Works, Sarasota County, FL** – Construction Project

**ATMS Design phases A,B,C,D and E, Osceola County Public Works,**

**Osceola County, FL** – Senior Network Engineer

**SR 21 ATMS, FDOT District 2, Jacksonville, FL** – Senior Network Engineer and Field Integration Project Manager

**ATMS Expansion, City of Orlando, Orlando, FL** – Senior Network Engineer
PART III
Proposed Pilot Deployment Approach
Proposed Pilot Deployment Approach

The THEA vision and Pilot Deployment Approach will employ systems engineering discipline to create a synergistic suite of safety and mobility applications, across modes and jurisdictions to solve real-world problems in the Tampa metropolitan area. We will demonstrate a scalable set of solutions that can be rolled out across this metropolitan area, but also in other urban environments across the country. To effectively prepare for the Connected Vehicle (CV) Pilot Deployment, THEA will develop a detailed pilot approach, identify appropriate participants, plan the pilot environment and determine how to monitor the pilot. Only through the development of a structured plan can THEA and the USDOT effectively manage implementation, monitor activity and results, and systematically enhance the deployment through Phases 2 and 3.

The THEA team’s approach to the CV pilot deployment, shown in Figure 3-1 includes a four-step continuous improvement approach that leverages the Plan-Do-Check-Act, or PDCA, Model.

**Plan:** Develop a comprehensive pilot deployment plan. Establish objectives and processes needed to deliver results. Develop structure, methods and processes to measure effectiveness.

**Do:** Launch the pilot according to the details documented in the pilot deployment approach. In some scenarios, it may become evident early on in the pilot that changes are immediately required to ensure the pilot can run to completion. Implement changes using change management processes to allow the pilot to run, providing that the changes are well documented and understood by the project team and USDOT. Communicate with all pilot participants. The pilot participants must know what their responsibilities are throughout the pilot. Before the pilot launch, participants should understand the objectives of the pilot, what to do if issues arise and the obligations they will have while the pilot is being conducted.

**Check:** Monitor CV application usage. Understand how each application is used by the participants throughout the pilot deployment. Document the behaviors and findings of the pilot participants. Report the results of each CV application monitoring to affected teams such as development, technical and project management. Monitor the physical and technical environment. Monitor the pilot participants throughout the operation of the pilot.
deployment. Track technical issues identified throughout the pilot. Track the errors, behaviors and performance of each application. Use the pilot participant group as a base for extrapolating system performance measures. Employ standardized evaluation reports and surveys to gain understanding of the advantages and disadvantages of each piloted application.

**Act:** Software enhancements or documentation updates are common requirements resulting from pilot deployment monitoring. Understand how the pilot participants interact with the applications and perform driving functions. Document any steps missing from process flows so they can be addressed. Work with USDOT and other pilot deployment sites to share data and lessons learned. Openly collaborate and commonly agree on changes needed to improve functionality and/or performance of each application.

Among several responsibilities that must be recognized, the THEA team agrees that:

- It has a duty to share data and open source code with the broader deployment community.
- It will allow interfacing with the national SCMS and use SCMS as a tool to support general deployment security.
- It will use CVRIA and SET-IT tools.
- It will work with other USDOT Pilot Deployments to enhance the capability of the program to achieve USDOT goals and continuously improve the pilot deployment site in a collaborative approach.
- It will cooperate and work with USDOT assigned independent evaluators.

**Deployment Vision**

**CONNECTED VEHICLE PILOT DEPLOYMENT — DOWNTOWN TAMPA**

![Map of Downtown Tampa Central Business District](image)

*Figure 3-2 Main Transportation Features of the Downtown Tampa Central Business District*
The THEA Connected Vehicle Pilot Deployment in downtown Tampa aims to create a safe, mobile and connected urban environment to measure the effect and impact of CV in a vibrant downtown. To that vision of a connected downtown, the proposed Pilot Project offers several CV applications that can be deployed in Tampa’s Central Business District (CBD) and environs.

This environment has a rich variety of traffic, mobility and safety situations that are amenable to V2V, V2I and V2X solutions. The deployment area is within a busy downtown and offers an expressway – street level interface, bus and trolley service, high pedestrian densities, special event trip generators and high dynamic traffic demand over the course of a typical day. These diverse environments in one concentrated deployment area collectively encompass many situations that allow for preparation of CV applications for deployment and performance testing. The applications offered are within the scope and vision of current development efforts as are presented in this narrative.

Proposed Pilot Deployment Site

Downtown Tampa is bordered by Ybor Channel (Cruise Ship and Commercial Port Channel) to the east, Garrison Channel (local waterway) to the south, Florida Avenue to the west, and Scott Street to the north. A virtually flat topography near sea level helps to simplify the evaluation of traffic flow parameters (see Figure 3-2).

Transportation System Features

Figure 3-2 illustrates the main transportation features of the downtown Tampa CBD:

- The Tampa Hillsborough Expressway Authority (THEA) owns and operates the Selmon Expressway and the Reversible Express Lanes (REL), a reversible elevated express lane, an all electronic toll (AET) facility that serves as a main commuter route connecting the community of Brandon (a large residential area with a population of 103,000) and Interstate I-75 with downtown Tampa, the Tampa Cruise and Commercial Port, and MacDill Air Force Base (MAFB). REL traffic exits at the intersection of Twiggs Street and Meridian Avenue in downtown. The Selmon Expressway, also AET, runs parallel to the REL and Exits 7 and 8 deposit and collect traffic downtown as well. The final exit is at Dale Mabry Highway, which is the location of MAFB’s main gate. Since the spring of 2010, all vehicles on the expressway are tolled electronically as they pass under gantries that hold the tolling equipment. Payment is made through SunPass or license plate-based accounts.

- THEA’s Selmon Expressway was the test bed for connected vehicles on the Audi Autonomous Vehicle Pilot, and THEA is a member of the USDOT Affiliated Test Bed Program for Connected Vehicles.

- THEA’s Selmon Expressway can facilitate real-time traffic tests in a closed course environment. Taking advantage of this unique functionality, THEA conducted its first test on the REL of the Selmon Expressway which was closed for several days from 10 am–4 pm in late July 2014 while Audi tested its Audi Connect A7 autonomous vehicle.

- I-275 Exit 44 connects to the study area on the northwest onto N. Orange Avenue.

- Meridian Avenue is a major gateway to downtown Tampa and will be the focal point for several of this pilot’s applications. Channelside Drive, on the east and south borders of the test area, connects to Amalie Arena and the Tampa Cruise Ship Terminals.

- Hillsborough Area Regional Transit (HART) bus lines route through this area and express routes utilize the REL for commuters from the Brandon area. The Marion Transit Center is in the northwest section of the test area on Marion Street at Laurel Street near I-275.

- The TECO Line Streetcar Trolley extends through the project area servicing local businesses and the
Amalie Arena and Tampa Cruise Ship Terminals which are important special event traffic generators
• Tampa Port Authority operates three International Cruise Ship terminals located in the project area as well as a commercial port area.
• The Tampa Central Business District (CBD) has a high volume of pedestrian activity and an active bike share program.
• There are numerous THEA-leased, City-run and private parking garages/lots in downtown.

MacDill Air Force Base is located eight miles south of downtown Tampa adjacent to the western terminus of the Selmon Expressway. A large number of vehicles enter/exit the base daily. Also, the base has a Transportation Incentive Program (TIP) in which about 1,450 base personnel use express bus or van pools. The TIP provides monthly express HARTline bus passes to commuters who live in suburban areas east of Tampa. The van pool program provides commuters, in groups of five or more, funding to secure a passenger van for their daily commute.

General Transportation-Related Issues and Mobility, Safety and Environmental Needs of the Site

The pilot deployment area experiences several different mobility and safety issues on a daily basis. Many of these issues can be resolved with connected vehicle applications. The list below offers a sample of the transportation issues faced in the deployment area (see Figure 3-2):
• The Selmon’s REL toll lanes’ morning commute endpoint is at the intersection of Twiggs Street and Meridian Avenue. Twiggs Street and Meridian Avenue are also major routes for HART buses into and out of the downtown Tampa CBD. Drivers experience significant delay during the morning peak hour resulting in, and often caused by, a correspondingly large number of rear-end crashes and red light running collisions.
• Meridian Avenue and West Kennedy Blvd experience transit signal delay, pedestrian conflicts, red light running and signal coordination issues.
• At the Hillsborough County Courthouse on Twiggs Street, there is significant competing vehicular and pedestrian traffic during the morning peak hour.
• Vehicles and pedestrians conflict with The TECO Line Streetcar Trolley at crossing locations throughout the project area, particularly along Channelside Drive.
• On the east portion of the project area along Channelside Drive corridor, visitors experience delays and path-finding difficulties associated with arrivals and departures at the International Cruise Ship terminals and the Amalie Arena.
• MacDill AFB experiences long queue times at controlled access points during the peak morning arrival time. They have recently approached THEA in regards to adding Dynamic Message Signs (DMS) at decision points to facilitate the dissemination of queue time and alternative entry point information. A study is currently underway to determine the best approach to this issue and it is likely that the project will benefit from this pilot by adding a CV component. MAFB presents an opportunity to create a fleet of vehicle probes for data collection. This is possible through its commuter vehicle population and through its Transportation Incentive Program that has van pool vehicles in addition to HART buses.

Performance Measures Relevant to Identified Needs

Performance measures tie closely to the vision of this Pilot Deployment and aim to reliably inform the effect of the CV applications with measurable statistical significance and their projected value with increased market penetration. Each CV application treatment has its own strong points relative to performance measures and each has its specialized data gathering potential. THEA has already started collecting the pre-deployment
baseline of traffic data to accurately describe current performance under existing conditions. Performance measures will be modeled and simulated to project with the post-deployment each CV application. Phase 1 will investigate the application of performance measures in Task 5. Performance measures for mobility, emissions reductions, safety/crash avoidance, and public agency efficiency are discussed briefly.

**MOBILITY**
Local traffic performance measures include: intersection and arterial volumes, travel time, delay, queue lengths and densities – by mode. In addition to the local performance measures of traffic, the cordoned test area outlined above allows for additional network-wide measures of performance enhanced by the special data gathering potential of CVs.

The morning peak hour, when this area experiences the highest delay, will be the primary focus of the pre- and post-deployment performance analysis:
- Morning peak hour travel time runs will be conducted for the study segments.
- Morning peak hour queue length data and intersection delay data will be collected for the signalized study intersections.
- Bus route times will be recorded for the impacted bus routes on the REL and within downtown Tampa.
- Vehicular travel times, bus route times, queue lengths and intersection delays pre- and post-deployment will be compared.

The project also aims to measure or estimate network-wide effects (e.g., path travel times, origins and destinations) to assist drivers and area-wide system managers. Since connected vehicles create data rich environments, we seek to measure and evaluate the extensive data that our vehicle agents (e.g., equipment, transponders, etc.) can supply.

**EMISSIONS REDUCTIONS**
Estimates will be made of emissions reductions and fuel consumption that correspond to improvement in speed, delay and idling time at signals. It is expected that appropriate data will be made available for the Hillsborough MPO emissions model. Direct measurement of fuel consumption and emissions is expected as a feature of the trials. The Environmental Protection Commission of Hillsborough County and Florida DEP may be interested in data collection efforts of this Pilot Project.

**SAFETY/CRASH AVOIDANCE**
Safety and crash performance will be measured through the comparison of pre- and post-deployment data, as well as projected amounts with greater market penetration based on our test cases.

**PUBLIC AGENCY EFFICIENCY**
The project will assist with data collection efforts with respect to area-wide traffic system management which falls under the purview of the FDOT District 7 Tampa Bay SunGuide Center, Hillsborough County TMC and City of Tampa TMC. Operations at the Hillsborough County Courthouse will be enhanced by the Pedestrian Safety CV application discussed in the next section. Phase 1 will allow exploration of how some data sets, such as those mentioned in mobility and emissions performance measures above could be made available for use by transportation agencies in the Tampa Bay area.
Proposed Use of CV Applications

The THEA Pilot Deployment aims to use a synergistic array of CV applications. In combination these applications will test the technologies, identify traveler behaviors that might be unforeseeable without field testing, measure performance, and ultimately achieve the potential of CV and AV in a busy downtown.

THEA’s Pilot uses of CV applications will realize multiple synergistic effects. Each of the CV uses listed below aims to bring together complementary CV applications. For example, in the Morning Peak Hour Queues, the CV applications synergistically integrate the complementary technologies of curve identification, forward

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**Figure 3-3: Proposed CV Applications and Needs**

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Tampa Hillsborough Expressway Authority
collision warning and intelligent signals. Another example is in the Wrong Way Entries use of CV intersection movement assist, intelligent traffic signals and probe-enabled traffic monitoring collaboratively conjoin for safety benefits. These synergies aim to capitalize on inherently complementary capabilities, and so reduce costs and increase benefits for drivers, businesses, insurance companies, among others affected by delay and safety considerations.

The program also tests and deploys a variety of communications technologies. Dedicated Short Range Communications (DSRC) are intrinsically built into the THEA program. Non-DSRC communications are tested, for example, in the Pedestrian Safety CV application, where V2D may be implemented by utilizing WiFi Direct technologies to communicate safety messages between application-enabled smartphones to connected vehicles.

As shown in Figure 3-3, the THEA Pilot Deployment will use CV applications identified and developed by the USDOT. The uses of CV applications shown in the figure are described next.

**MORNING PEAK HOUR QUEUES**

The intersection of Twiggs Street and Meridian Avenue at the entrance/exit to the REL experiences long queues during the morning rush hour due to poor signal progression and right turns onto Twiggs immediately followed by a second right turn onto Nebraska Avenue. This causes the queue to back up onto the Selmon Express Lanes exit and into the curve where rear end crashes and other incidents are occurring. Potential CV technologies proposed for this location are V2I and V2V. Queue detection with V2I can be developed with one (1) 5.9 DSRC RSE in the curve for speed-curve warning and a cellular data link for advance warning at the 34th Street exit. A V2V solution would involve brake warning and speed-curve warning applications using 5.9 DSRC and cellular data for advance warning. Performance would be measured by delay, queue lengths and crash data.

Applicable USDOT developed CV applications include:
- Curve Speed Warning (CSW) (V2I Safety)
- Emergency Electronic Brake Lights (EEBL) (V2V)
- Forward Collision Warning (FCW) (V2V)
- Intelligent Traffic Signal System (I-SIG) (Mobility)

**WRONG-WAY ENTRIES**

The entries to the REL experience wrong way entries caused by unique intersection dynamic signing for reversible express lane open/close procedure and state. Potential CV technologies proposed for this location are V2I and V2V. A potential V2I solution is for vehicle to traffic signal communications to demonstrate onboard signage alerting driver of potential wrong way entry and the correct course to take. Forward collision warning application demonstration is a possible V2V application. Performance would be measured by observed wrong-way events and crash data.

Applicable USDOT developed CV applications include:
- Intersection Movement Assist (IMA) (V2V Safety)
- Intelligent Traffic Signal System (I-SIG) (Mobility)
- Probe Enabled Traffic Monitoring (Agency Data)

**PEDESTRIAN SAFETY**

Twiggs Street at the Hillsborough County Courthouse has a mid-block pedestrian crossing combined with no protected left turn into the parking garage for the courthouse. This creates pedestrian safety issues as they traverse Twiggs Street. Additionally, pedestrians are crossing at unmarked locations, further complicating the
pedestrian safety concern. Potential CV technologies proposed for this location are: V2I, V2V and V2D. For V2I, the pedestrian crossing may be equipped with 5.9 DSRC RSU and/or WiFi Direct technologies to alert driver of potential pedestrian safety issue via onboard signage or other alert. An applicable V2V solution is a vehicle to vehicle pedestrian warning. V2D may be implemented by utilizing WiFi Direct technologies to communicate safety messages between application enabled smartphones to connected vehicles. Performance would be measured by the number of recorded alerts, observed and reported conflicts and crash data.

Applicable USDOT developed CV applications include:
- Pedestrian in Signalized Crosswalk Warning Transit) (V2I Safety)
- Mobile Accessible Pedestrian Signal (PED I-SiG) (V2I Safety)
- Intelligent Traffic Signal System (I-SiG) (Mobility)

**BUS RAPID TRANSIT SIGNAL PRIORITY OPTIMIZATION, TRIP TIMES AND SAFETY**

HART operates an express route along and through the downtown city streets to the Marion Street Transit Station. Bus Rapid Transit (BRT) routes offer efficiency gains in moving more people; however, during peak periods, the BRT service suffers from poor signal progression due to heavy volumes and passenger vehicles blocking access to bus stops. Potential CV technologies proposed for this location are V2I. A connected bus application with the traffic signals along the route would reduce trip times and increase reliability of the route. The performance of this application would be measured by capturing real-time data to estimate path and intersection bus travel time savings and person-hours saved.

- Applicable USDOT developed CV applications include:
  - Intelligent Traffic Signal System (I-SiG) (Mobility)
  - Transit Signal Priority (TSP) (Mobility)

**TECO LINE STREETCAR TROLLEY CONFLICTS**

The Amalie Arena/Channelside Drive Area is a tourist destination and event area. Channelside Drive experiences many types of safety and mobility challenges due to morning and afternoon peak alternate routes, special events, the streetcar trolley and the cruise terminal at the Port of Tampa. Depending on the time and day at least two of the issues identified above have a negative impact on overall safety and mobility in the area. Potential CV technologies proposed for this location are V2I, V2V and V2D. The V2V safety application, Vehicle Turning Right in Front of Bus Warning, may be used to solve a need related to vehicle-to-trolley conflicts. V2I may be utilized in this area by equipping the pedestrian crossings with 5.9 DSRC RSU and/or WiFi Direct technologies to alert the driver of a potential pedestrian safety issue via onboard signage or other alert. Vehicle to vehicle warnings may be applied to reduce conflicts. A potential V2D solution will utilize WiFi Direct technologies to communicate safety messages between application enabled smartphones to connected vehicles for safety. Performance would be measured by the number of alerts when pedestrian warning heeded and not heeded and instances of automated control, observed and reported conflicts and crash data.

Applicable USDOT developed CV applications include:
- Vehicle Turning in Right Front of Bus Warning ( V2V Safety)
- Intelligent Traffic Signal System (I-SiG) (Mobility)

**ENHANCED SIGNAL COORDINATION AND TRAFFIC PROGRESSION**

The area of downtown Tampa from the Selmon Express Lanes along Twiggs Avenue to Marion Street and along Meridian Avenue to Channelside Drive experience a significant amount of queuing and congestion occurs during the morning peak periods as well as during special events. Drivers from MAFB experience
long wait times at base controlled access points, further contributing to these backups. Selected commuters from MAFB will be equipped with Vehicle Awareness Devices (VADs) to act as probe vehicles. Additional participant drivers may be obtained by soliciting existing THEA toll tag customers. V2I technology may be utilized by equipping the traffic signals along these arterials with Road-Side Units (RSUs). Vehicles with VADs will communicate with traffic signals and traffic management software. Software will analyze real-time data coupled with historical data from VADs to optimize signal progression. Performance would be measured by the trip times along the arterials by Time of Day with and without VAD, capturing real-time data to estimate the time savings.

Applicable USDOT developed CV applications include:
• Probe Enabled Traffic Monitoring (Agency Data)
• Intelligent Traffic Signal System (I-SIG) (Mobility)

Team Partners and Key Stakeholders
THEA is the lead agency and HNTB is employed as the program manager for the three Phases of the project. Overall pilot deployment programmatic control will reside with Joe Waggoner, Executive Director of THEA.

As outlined in Volume 1, Part 2, Team Members, Partners and Stakeholders are involved in the project. Team Members are those performing the project. Partners support the program and potentially benefit from the program. Stakeholders include partners and others, such as Vendor Stakeholders, who benefit from the program indirectly, for example, through participation and testing of their new technologies.

Phase 1 Tasks 1-13 are led by Team Members who also support other Tasks. With their Lead Tasks, the Team Members are:
• THEA (Lead agency) – Task 10
• HNTB (Consultant Program Manager) – Tasks 1, 2, 4, 6, 8, 12, 13
• BAH – Tasks 3, 7
• University of South Florida CUTR – Task 5
• Global-5, Tasks 9, 11
• Siemens - Task support for Tasks 1, 2, 6, 7, 8, 9, 10, 11, 12, 13

Phase 1 will involve multi-agency collaboration with the following key Partners:
• The City of Tampa (COT),
• Hillsborough Area Regional Transit (HART)

In addition to the Partners, who are also Stakeholders, the expanded list of Stakeholders includes:
• MacDill Air Force Base (MAFB)
• Florida Department of Transportation, District 7
• TECO Streetcar Line
• Tampa Bay Port Authority
• Coast Bike Rentals
• Tampa International Airport
• Hillsborough County
• BMW/GEWI
• Amalie Arena
• University of Tampa
• River Walk
• Glaser Children’s Center
• Channelside Entertainment District
• Tampa Convention Center
• Cruise Port
• Florida Aquarium
• Curtis Hixon Park
• Area museums
• Others, such as rental car agencies, parking suppliers, the enforcement community, local coalitions, neighborhood groups, will be identified in Phase 1.
• These key Partners and Stakeholders will be involved throughout Phases 1, 2 and 3 of the project. In addition, MetroTech will lend its expertise and support to the program as a Vendor stakeholder in Phases 2 and 3.

The Partner and Stakeholder register will be maintained by the Program Management Lead (PML) and will be updated as the concept is refined to include potential new stakeholders with an interest in the project. THEA has and will continue to mitigate inter-jurisdictional risks by initiating pre-pilot MOUs, letters of support/commitment and service level agreements as applicable.

Key Technical and Organizational Risks

Risks exist both of an organizational and technical nature. While that may be so, every effort will be made to minimize risk as explained in the Risk Management Plan of the Program Management Plan.

The Safety Management Plan (Task 4) will realize significant reduction of risk, particularly of a technical nature. Risks will be minimized by developing and following Safety and Requirements Task items. The project is designed to minimize or eliminate delays while maintaining safety and performance.

There are several key technical and organizational risks that have been identified and countermeasures planned. HNTB will lead this work for the THEA team, bringing their extensive experience with safety considerations on roadway and transit projects, but also in the connected vehicle environment.

The key technical risks are associated with the hardware and software. There could be bugs with the implementation and operation of the equipment and applications installed. If the applications that relate to safety fail, this may result in crashes involving vehicles, pedestrians, bicycles, buses, or the trolley. Traffic flow may be impeded if the applications that enhance signal coordination and traffic progression fail. We will address these risks by designing the system to be as fail-safe and fault tolerant as possible. Software and devices will be beta tested on a Sunday when there are no special events in the area and traffic is lowest, then during off-peak periods, and then only during peak period when results can be expected to be safe.

The key organizational risks are associated with turnover in staff and key personnel involved in the project. We will address these risks by proposing a team with a large depth of staff and resources available, built upon long-term relationships that have been established over years of working together. Our team has redundancy in capable staff as well as a thorough contingency plan to replace key personnel over the life of the project.

Projected Pilot Deployment High-Level Three-Phase Budget and Schedule

The projected pilot deployment approach is presented at a high-level vision in a three-phase program of development. HNTB has considerable experience as designers and have transferred these skills successfully as system developers.
The Work Flow is envisioned in the V-Diagram shown in Figure 3-4. It summarizes at a high level the activities to be performed and the results that have to be produced during the life cycle of the THEA Connected Vehicle Pilot Deployment Program.

PHASE 1 CONCEPT DEVELOPMENT
The approach to Phase 1 has been outlined in this proposal as Tasks 1-13 and in the preceding section on Deployment. The PML, CDL and SDL will prepare the organization of activities and personnel and carry out the parallel development of program elements as discussed in Task 1.

One year is allocated to Phase 1.

PHASE 2 DESIGN/DEPLOY/TEST
Prior to operation, the component equipment, systems and subsystems will be designed, built and bench and field tested in controlled environments as Safety (Task 4) and other Requirements (Task 6) outlined in the completed Phase 1 Tasks will require.

As it did with the concept development phase, Phase 2 will continue to follow established system engineering processes. Using the V-model as a reference, we will advance the Phase 1 concept into a robust design and pilot deployment, working within and expanding as necessary, the existing Tampa Bay Regional ITS Architecture. SET-IT and CVRIA will be used during the Project System Engineering Management Plan (PSEMP) development.

The PSEMP will be developed and updated throughout the deployment phase. The various levels of component and system testing will include:

- System Architecture and System Design – The THEA and Tampa Bay Regional ITS Architecture will be expanded and refined to include integration with connected vehicles and other components that will interconnect these systems and create a common database for operations and performance measurement.

Figure 3-4 The V-Diagram and Table 1-1 Activity Table shows how these activities will integrate into Phase 2 and 3:
### Table 1-1 Phases 2 and 3 Activity Table

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>PROJECT PHASE</th>
<th>V-MODEL SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Detailed design</strong></td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Infrastructure site selection</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Site design</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Vehicle selection and assessments</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Data collection plan</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Development of installation plans</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Test plan development,</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Interface definition,</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Prototyping</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Training, design documentation</td>
<td>II</td>
<td>Detailed Design</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td>II</td>
<td>Software/Hardware Development</td>
</tr>
<tr>
<td>Procurement of contracted services for installation</td>
<td>II</td>
<td>Field Installation</td>
</tr>
<tr>
<td>Procurement of materials</td>
<td>II</td>
<td>Field Installation</td>
</tr>
<tr>
<td>Installation oversight/CEI services</td>
<td>II</td>
<td>Field Installation</td>
</tr>
<tr>
<td>Data capture system enhancements,</td>
<td>II</td>
<td>Field Installation</td>
</tr>
<tr>
<td>Performance monitoring</td>
<td>II</td>
<td>Field Installation</td>
</tr>
<tr>
<td>Reporting system development/enhancements,</td>
<td>II</td>
<td>Field Installation</td>
</tr>
<tr>
<td><strong>Integration and testing</strong></td>
<td>II</td>
<td>Unit/Device Testing</td>
</tr>
<tr>
<td>System integration</td>
<td>II</td>
<td>Unit/Device Testing</td>
</tr>
<tr>
<td>System and interoperability tests</td>
<td>II</td>
<td>System Verification</td>
</tr>
<tr>
<td>System acceptance testing,</td>
<td>II</td>
<td>System Verification</td>
</tr>
<tr>
<td>Data and performance measure validation</td>
<td>II</td>
<td>System Validation</td>
</tr>
<tr>
<td>Operational readiness review</td>
<td>II</td>
<td>System Validation</td>
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<tr>
<td>Burn-in,</td>
<td>II</td>
<td>System Validation</td>
</tr>
<tr>
<td><strong>Final “as-built” documentation</strong></td>
<td>II</td>
<td>System Validation</td>
</tr>
<tr>
<td><strong>Inter-Pilot Collaboration</strong></td>
<td>II &amp; III</td>
<td>System Validation</td>
</tr>
<tr>
<td><strong>Operations</strong></td>
<td>III</td>
<td>Operations and Maintenance (O&amp;M)</td>
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<tr>
<td>Operations integration</td>
<td>III</td>
<td>(O&amp;M)</td>
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<tr>
<td>Data capture</td>
<td>III</td>
<td>(O&amp;M)</td>
</tr>
<tr>
<td>Performance monitoring and reporting</td>
<td>III</td>
<td>(O&amp;M)</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>III</td>
<td>(O&amp;M)</td>
</tr>
<tr>
<td>Asset management and performance management processes</td>
<td>III</td>
<td>(O&amp;M)</td>
</tr>
<tr>
<td>System support services,</td>
<td>III</td>
<td>(O&amp;M)</td>
</tr>
<tr>
<td>Continuing enhancements for system reliability and security</td>
<td>III</td>
<td>Changes &amp; Upgrades</td>
</tr>
<tr>
<td>Evaluation Support</td>
<td>III</td>
<td>Changes &amp; Upgrades</td>
</tr>
</tbody>
</table>

*Activity Table – Part of Figure 3-4*
• Application Enhancement and Integration – The Connected Vehicle Pilot Applications will be developed, bench tested and field tested for meeting of all Requirements. Integration of Systems will be tested according to Interface Requirements, especially to meet Functionality, Performance and Data Requirements.

• Pilot Deployment System Build Out – The system will be built to specifications established in Phase 1 as outlined in this document.

• Pilot Site Preparation for System Interoperability Test – Tests will be conducted by subsystem and built into a full system according this Deployment Plan.

• System Interoperability Test (including security and interface tests) – All systems will be methodically interconnected to allow for subsystem testing and complete performance monitoring.

• A period of 20 months is allocated to Phase 2.

**PHASE 3 OPERATE AND MAINTAIN**

The Con-Ops, PSEMP and other key documents and plans developed in Phase 1 and followed in Phase 2, will continue to drive the operations and maintenance (O&M) in Phase 3. Stakeholder involvement and public outreach will still play a key role and promote constructive feedback to further enhance performance measure validation. And during this phase in particular, the team will coordinate with other pilots to facilitate shared body of knowledge and document lessons learned.

Key performance measures will assess the impacts on mobility, safety and social systems. Monitoring will be done daily, weekly and monthly. The team will continue to engage stakeholders for anecdotal information on enhancements to agency efficiency and public perception. Performance and related data will be shared with a USDOT independent evaluator.

The V-Diagram and Activity Chart above in **Figure 3-4** shows the following activities for Phase 3:

**Operations**
- Operations integration
- Data capture
- Performance monitoring and reporting

**Maintenance**
- Asset management and performance management processes
- System support services,
- Continuing enhancements for system reliability and security
- Evaluation Support

A period of 18 months is allocated for Phase 3.

**Schedule Risks**

As required the schedule will be updated monthly, if not more frequently. Since this Phase 1 does not include design, deployment, integration or operation, external factors that can cause delay should be minimal. Other factors that may cause delay during concept development phase include agency procurement, partnering or contracting issues and stakeholder engagement difficulties, including scheduling meetings and calls, inter-jurisdictional disagreements that may arise and intellectual property disclosures during concept development.

Schedule risks, such as these will be identified quickly and addressed through the THEA Risk Management Plan. THEA has and will continue to mitigate inter-jurisdictional risks by initiating pre-pilot MOUs, letters of support/commitment and service level agreements as applicable. The Schedule Management Plan will include
weekly meetings with task leaders to identify and address schedule adherence. When tasks are not keeping pace with the baseline schedule, mitigation efforts will be undertaken to bring the task in line.

### High-Level Three-Phase Budget

THEA has developed a high-level, three-phase budget that provides a high-level cost estimation of all three phases of the pilot deployment. The procedures used to develop the cost estimation are three-fold:

- Use of the detailed fixed price proposal of Phase 1 (this solicitation).
- Rough order of magnitude cost estimations from subcontractors and other vendors for Phases 2 and 3.
- High-level cost estimation outputs from the USDOT-supplied high-level cost estimating tool (CO-PILOT).

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Cost</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Concept Development</td>
<td>$2,443,071.25</td>
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<tr>
<td>Phase 2</td>
<td>Design/Deploy/Test</td>
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<tr>
<td>Phase 3</td>
<td>Maintain/Operate Pilot</td>
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<td>11%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>$17,704,487.20</strong></td>
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