Proposal for

DESIGNATION *of* AUTOMATED VEHICLE PROVING GROUNDS PILOT

Central Florida AV Partnership:

City of Orlando

University of Central Florida

FAMU - FSU College of Engineering

Florida's Turnpike Enterprise

Florida Department of Transportation D5

Florida Department of Transportation D1

Central Florida Expressway

LYNX

NASA, Kennedy Space Center

DECEMBER 19, 2016

DOCKET NO. DOT-OST-2016-0233

EXECUTIVE SUMMARY

The Central Florida Automated Vehicle (AV) Partnership is pleased to submit this proposal for the designation of Automated Proving Ground for its participating facilities and future expansion of Partnership members' facilities. As a designated AV proving ground, Central Florida would showcase and share findings on local, regional and national platforms to advance these technologies in support of future mobility and transportation safety. In addition to meeting all mandatory criteria sought by the USDOT, the Central Florida AV Partnership proposal offers the following advantages as a USDOT-designated AV proving ground:

1. A unique multidisciplinary, multimodal partnership provides additional investment and long-term operation of the proving ground;
2. A three-tiered approach to leverage the resources of our partnership for testing and deployment sites to meet USDOT long term needs;
3. An environment that attracts 70 million visitors each year to demonstrate the benefits of AV technology and to promote user acceptance.

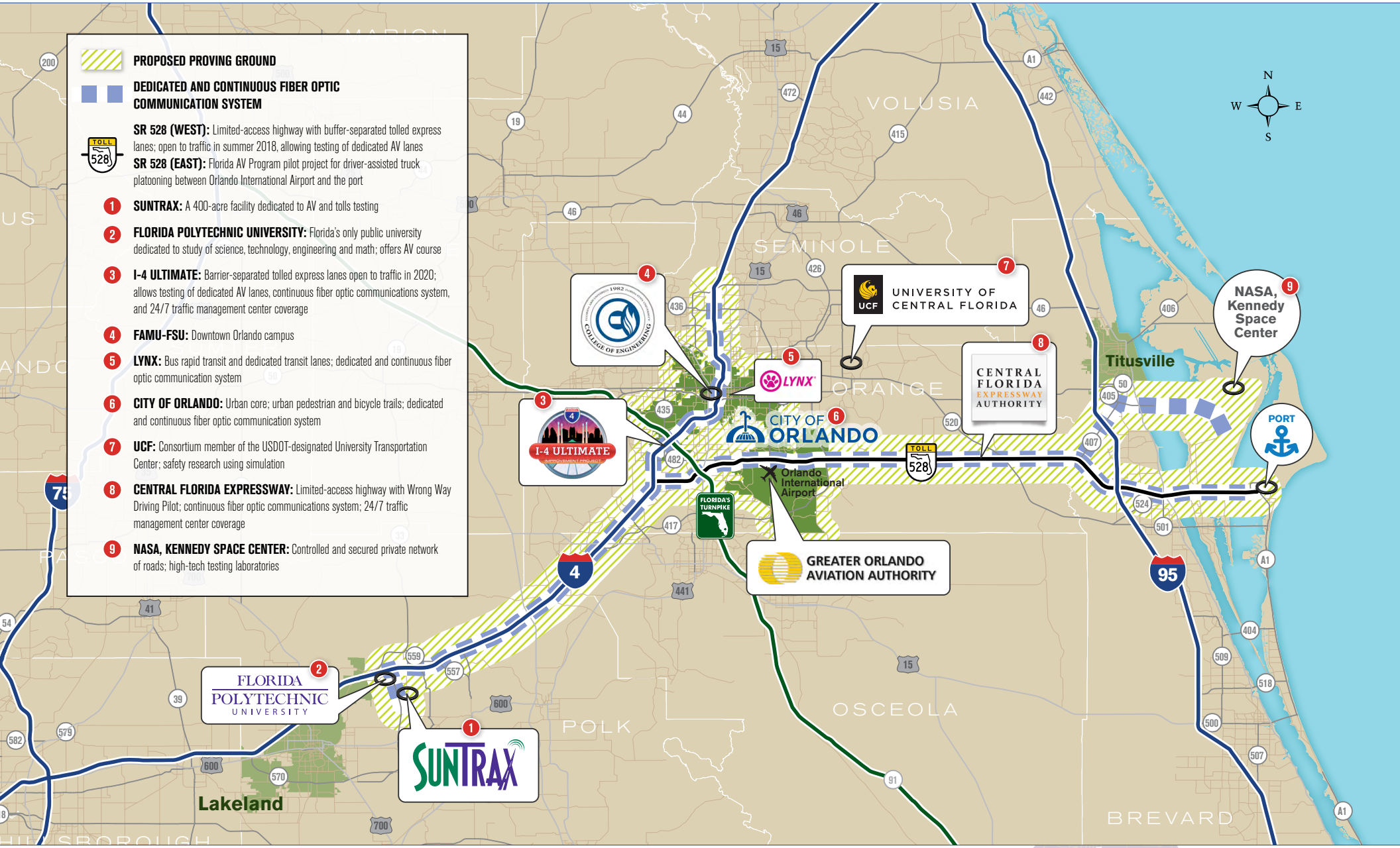
This approach reduces potential risks and ensures adherence to a partnership-wide safety management plan by validating safety standards through each tier. The three tier approach will provide a platform to share data in a step by step process, highlighting the progression of testing for every mode of transportation, including autos, freight, transit, bicycle and pedestrian, to be included from simulation to open road testing.

As the first step in the process, University of Central Florida (UCF), Florida A&M University-Florida State University (FAMU-FSU), and Florida Polytechnic University (Florida Poly) bring a wealth of research and simulation experience, a multidisciplinary approach with programs in Engineering, and an AV development program through Florida Poly. UCF and Florida Poly have developed an academic rigor in testing practices, transitioning projects from academics to implementation. In addition to multidisciplinary engineering programs, FAMU-FSU provides a resource with the College of Law to assist in safety and policy compliance review for testing.

One of the two proposed controlled testing facilities in Central Florida is SunTrax, a new transportation technology testing facility that includes a 2.25-mile, oval track on a 400-acre site, centrally located between Tampa and Orlando. The track includes infrastructure and mounting locations for roadside units and tolling equipment, while the 200-acre infield will be dedicated to controlled AV and CV testing for arterial environments. NASA will provide the second controlled testing facility at Kennedy Space Center (KSC), which offers the ideal controlled environment with a vast roadway network and secure access. KSC can conduct controlled extreme environment testing for significant weather events and unusual roadway conditions.

The third tier of proposed testing involves deployment on select Central Florida highways, roadways and transit routes. I-4, SR 540, and SR 528 (**Figure 1**) comprise the proposed limited-access highways and arterials in Central Florida. Florida's Turnpike Enterprise (FTE), Central Florida Expressway Authority (CFX) and FDOT District Five are providing support to make these facilities available. Proposed transit option includes the bus rapid transit (BRT) LYMMO route in downtown Orlando, providing connections to both rail (SunRail), regional transit (LYNX) and Juice Bike Share locations.

Figure 1: Overview of Proposed Central Florida AV Proving Ground



ELIGIBILITY INFORMATION

Minority Institution	The partnership includes FAMU-FSU, an accredited minority institution
Test Track and Testing Facility	• SunTrax Tolling and Automated Vehicle Testing Facility • UCF Transportation Lab (2016 USDOT University Transportation Center [UTC], Simulation) • NASA, KSC (Roadway Network and Swamp Works Lab)
Cities/Urban Cores	City of Orlando (central business district; bus rapid transit; pedestrian and bicycle trails)
Highway Corridors	SR 528 (Beachline Expressway); I-4; SR 540 (Polk Parkway)
Campuses (Corporate or Academic)	UCF; Florida Poly; FAMU-FSU (downtown Orlando campus)

MANDATORY CRITERIA

Designated Safety Officer	**Anthony Nosse** (FDOT District Five Safety Officer). Nosse is committed to participating in regularly scheduled meetings and sharing safety lessons learned to the Community of Practice.
Commitment to Sharing	Partnership members have demonstrated an extensive history and commitment to sharing information and best practices to regional, and national organizations such as, USDOT and its research programs/offices, TRB, NCHRP, AASHTO, ITS America, IBTTA, ITE, and many others. The Partnership will continue and accelerate this commitment with USDOT and its program offices and share all non-proprietary data with the USDOT Research Data Exchange (RDE).

PROPOSED CONTRIBUTIONS

Established AV Program	The Florida Automated Vehicles (FAV) program was established in 2012 to lead the state in developing best safety practices, education models, and promote awareness for AVs and the relevant technology. This program continues today and includes several pilot projects and an annual summit to share ideas and best practices. www.automatedfl.com
Leadership in National and Regional Contributions	The Central Florida AV Partnership includes regional agencies and entities that have demonstrated leadership and significant contributions towards mobility challenges. This Partnership will continue to provide leadership by sharing information and providing further opportunities for testing and deployment of AV technologies.
Proposed Contributions to Community of Practice	All information, including safety management plans, testing data, lessons learned, and testing methodology will be proactively shared with the Community of Practice.
Willingness for Relationship with US DOT Research	Members are already active in working relationships with USDOT research program offices. The Partnership includes significant involvement from academia capable of conducting research, analyses and reporting efforts. The partnership will participate in regular meetings, pooled research efforts and conferences.

COMMITMENT TO SAFETY

Capability to Control Risks	Partnership members already have standard safety management plans, and are committed to publishing and maintaining an overall safety management plan for the proving ground testing and operations.
Safety Protocols, Safe Design, Deployment and Operation	Partnership members have demonstrated the ability to safely conduct testing in controlled environments and real world applications through established safety protocols, permitting processes, and risk mitigation plans.

RESEARCH, APPLICATION AND DATA SHARING

Extent of Applicant to Provide Applicable Solution for Broader Region	The Partnership includes broad regional involvement and state agencies that are able to share results and information statewide for the development of solutions that support the advancement of AV technology.
Research and Extension Resources	The Partnership includes three universities: UCF, Florida Poly and FAMU-FSU. These partners provide significant resources for researching the capabilities of AV technologies.
Ability to Disseminate Results	Florida Poly is already supporting the national deployment of AV technology through a committed educational program starting in spring 2017. The Partnership is committed to expanding this education program statewide through its institutional and training resources.
Commitment to Open Data Sharing and Sharing of Test Results	City of Orlando and FDOT have open data initiatives. The team's letters of commitment demonstrate a proactive willingness to share all data and test results.

DEMONSTRATED INVESTMENTS

Capital Improvements	The Partnership members are providing substantial existing facilities and investments for the proving ground, including the UCF simulator, NASA Swamp Works, and an extensive controlled and public road network. Fully funded planned investments such as SunTrax, a $100 million state of the art AV testing site shows the commitment of the Partnership to continue advancing the proving ground capabilities.
Authorization of Proving Grounds, Legislation, Regulation	In 2012, House Bill 1207 first provided Florida with Automated Vehicle Testing Legislation. In 2016, House Bill 7027 expanded capabilities clearing way for all forms of AV Testing. A legislation evaluation is currently underway to address the USDOT policy guidance on AVs.
Testing Under Way	Central Florida's AV testing began in 2011 with the connected vehicle (CV)-affiliated test bed along I-4 and demonstrated at the ITS World Congress. Central Florida continues to participate in additional AV pilot projects documented on www.automatedfl.com.

READINESS

January 1, 2018	Many of the Partnership facilities are open for testing including the UCF Simulator, Orlando BRT and Urban Core Facilities, Limited Access Highway Facilities, and KSC. SunTrax construction will start in Spring of 2017 and be open for testing Fall of 2018. I-4 Ultimate is under construction and expected to open early 2021.
Open to Multiple Users	Florida's facilities are not affiliated with a particular vendor, allowing multiple users the opportunity to test on the proving ground.
Designated Point of Contact	**Michael Shannon**, Director of Transportation Development, Florida's Turnpike Enterprise Email: micheal.shannon@dot.state.fl.us / phone: (407) 264 3628 **Charles Ramdatt**, Director of Special Projects, City of Orlando Email: charles.ramdatt@cityoforlando.net / phone: (407) 246-3186
Engaged with Affected Communities	The Partnership includes members from all affected communities and will continue to provide public engagement to address any concerns regarding AV technology. The Letters of Partnership and Commitment signed by a representative from each Partner can be found in the **Appendix** to this application.

ADHERENCE TO LAWS, REGULATIONS AND FEDERAL POLICY

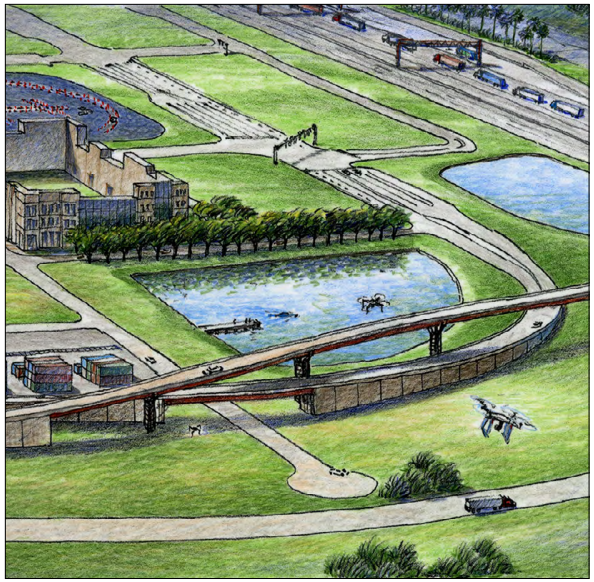
Address adherence to state/local laws and federal regulations	With Florida's enabling legislation AV testing is permitted with adequate insurance and a licensed operator. Enforcement on public roadways for approved AV technologies will be handled by the Florida Highway Patrol and local law enforcement agencies.
Demonstrate adherence to guidance from NHTSA policy on AV	The Partnership will use National Highway Traffic Safety Administration (NHTSA) policy as a guidance document to help develop an overall safety management plan and other policies such as permitting AV testing in the proving ground. Existing State legislation supports NHTSA policy and state model practices.

PROGRAM DEVELOPMENT

The three-tiered approach to testing at the Partnership's facilities provides an unparalleled proving ground with capabilities to objectively test every aspect of AV technologies. From simulation/emulation at state of the art universities, to controlled "test track" facilities offering extreme environmental and controlled scenario testing, to multimodal public facilities, the Central Florida AV Proving Ground offers the most comprehensive testing arenas. Utilizing this multi-tiered proving ground will allow for reduced risk, and stepped and phased proving of technologies. Having these capabilities within one proving ground creates a more robust result for best safety practices and validation of automated transportation technology. The following outlines the proposed proving grounds in detail, demonstrating the eligibility, capability, commitments, readiness, and overall compliance of the Central Florida AV Proving Ground.

SunTrax

The Florida Department of Transportation's Florida Turnpike Enterprise (FTE) and Florida Poly have committed to a long-term partnership to construct a new transportation technology testing facility, SunTrax. This testing site includes a 2.25-mile, oval track on a 400-acre site in Polk County, centrally located between Tampa and Orlando. The facility will be adjacent to FTE's Polk Parkway (SR 540) just two miles south of the Florida Poly campus. Design of the initial phase has been completed including an innovative toll testing facility replicating limited access conditions for high speed testing of tolling, and AV technologies. The oval track includes infrastructure such as shelters, buildings, gantry structures, and a variety of mounting locations for road side units and tolling equipment. The facility was designed around multiple scenarios such as single lane, multiple lanes, and parallel toll and express lanes. The facility offers an opportunity for national and international certification for AV and tolling technologies. This project will be advertised for construction in February 2017, and construction is expected to last for 18 months. SunTrax will be open for testing in the fall 2018. Design, construction, construction engineering, and inspection funds have already been appropriated and committed in



SunTrax is a 400-acre facility dedicated to tolls and AV testing. It is a controlled environment with safety and security protocols, and it features a 2.25-mile, high-speed oval designed for high-speed travel and multiple lanes. The vision for SunTrax includes the build-out of multiple environments, including a simulated downtown urban core, to test transit, vehicle, pedestrian and bicycle interactions with AVs.

FDOT's current work program fiscal year. The total construction value is estimated at $51 million. The project is unique in that it creates a symbiotic relationship between government agencies and educational resources. Not only will data and test results be generated, but the next generation of professionals are receiving hands-on training in the AV laboratory space.

The 200-acre infield of the track will be dedicated to controlled automated and connected vehicle (CV) testing for arterial environments. The infield will be developed with Florida Poly, allowing researchers to rigorously construct testing parameters on track infrastructure. This approach will also offer a unique opportunity for knowledge transfer as students and faculty design, oversee construction, test, and share findings of these technologies. Anticipated features include a learning laboratory, simulated city center, suburban and rural roadways, interconnected signalized intersections, interchange ramps, roundabouts, and various pavement surfaces. Areas of research include safety standards for environment, vehicular and pedestrian safety impacts, data management, cyber security, and equipment quality. This facility will provide a controlled and safe environment for testing these emerging technologies before they are deployed in live traffic. Furthermore,

SunTrax is strategically positioned outside of urban areas with hundreds of acres of land available for development, allowing private entities to setup their own facilities adjacent to the SunTrax test facility.

Florida Polytechnic University

Florida Poly was established on April 20, 2012, and is Florida's only public university dedicated to science, technology, engineering and mathematics (STEM). Florida Poly is designed to be different and is dedicated to the principle that innovation occurs when research and creativity are applied to real-world challenges. Florida Poly is located along the Polk Parkway (SR 540) and I-4, just two miles north of the SunTrax tolls and AVs testing facility. Florida Poly offers high-tech labs and learning spaces and continually seeks opportunities to work side by side with industry in research, entrepreneurship and collaboration, keeping Florida Poly at the edge of innovation. In the spring of 2017, Florida Poly will introduce a new course called "Autonomous Systems and Self-Driving Vehicles" in which students will build an AV for competition at the end of each semester.

Florida Poly is partnered with FDOT and FTE to develop SunTrax, a facility for the dedicated to research, development and testing of advanced transportation concepts such as AVs. This facility will provide a safe and controlled environment for testing these emerging technologies before they are deployed on public roadways. As part of SunTrax development, Florida Poly is proposing a comprehensive scenario testing solution, addressing the unique challenges for scenario testing in AVs.

NASA, Kennedy Space Center

KSC, under the operation of NASA, has been on the forefront of technology since its conception in the 1960s. Some of its greatest technologies are results of the efforts of the many developers and engineers that have dedicated their careers to reaching higher and helping society move into the future at NASA. Today, KSC is playing a critical role in the AV spectrum. Recent testing done for a major heavy equipment manufacturer analyzed the capabilities of some of the sensors used on AVs in extreme environments. The Swamp Works Laboratory team successfully created a calibrated extreme environment chamber, in which particulate and water vapor density can be accurately measured and provide for repeatable scenarios. This allows researchers and manufacturers to understand how software and hardware will react in extreme environments within a safe, controlled environment with very minimal risk. KSC, constructed to support a rapidly evolving and expanding space program, consists of over 564 miles of secured, private roadways (184 miles of paved roads and 380 miles of unpaved roads). This network of roadways offers an extensive urban type network, complete with pedestrian activated crosswalk beacons, and a bike share program. Unpaved and unmarked roads provide rural testing scenarios for AVs. These roadways also offer areas where extreme and hazardous conditions can be tested such as flooding, smoke/smog, fog and heavy rain inside the controlled facility with little risk.

The Swamp Works Laboratory team at KSC created a calibrated extreme environment chamber, in which particulate and water vapor density can be accurately measured and provide for repeatable scenarios. The proving ground has access to this cutting edge and innovative research laboratory for AV sensors and other hardware.

University of Central Florida (Transportation and Simulation Labs)

UCF is an innovation leader in simulation and testing practices. A recognized USDOT UTC member, UCF is home to the Institute for Simulation and Technology (IST), an internationally recognized research institute that

focuses on advancing human-centered modeling and simulation technology. The facilities and faculty at the UCF bring expertise in the study of the human machine interface. A component of IST is the Cognitive Sciences Laboratory, a critical component in both the CV environment and autonomous advancement from Level 2 to Level 5 technologies. Transportation research and education is predominantly carried out through the Center for Advanced Systems Simulation (CATSS), a nationally recognized research entity and housed in the CECE Department. The mission of CATSS is to advance U.S. technology and expertise, in the many disciplines comprising transportation, through the mechanisms of education, research, and technology transfer at university-based centers of excellence.

Interstate and Expressway Corridors (I-4, SR 528, and SR 540)

The proposed proving grounds public roadways include a number of limited access, high-speed facilities operated by FDOT Districts One and Five, FTE and the CFX. The continuous system of highway corridors comprises a total of 85 center line miles from SunTrax and Florida Poly to Port Canaveral. An additional 24 center lane miles of I-4 are part of the proving ground, including the I-4 Ultimate project. These roadways include tolled expressways, express lanes, freeway sections and a variety of different typical sections, levels of congestion and travel conditions. The western portion of SR 528 (Beachline Expressway) is projected to be under construction and will open buffer separated express lanes in summer 2018. I-4 Ultimate will be under construction until late 2020 and will open barrier separated express lanes in the winter 2020. As express lanes open to traffic, their detailed data collection systems will be available for additional points of observation and monitoring during tests.

Additionally, the expected series of projects under construction will allow testing of vehicles to collect data on the effect of traffic control devices on AVs. SR 540 would offer an additional testing area with direct connections to SunTrax and Florida Poly, allowing researchers and testers ease of access to laboratories and mechanical adjustment facilities.

These real-world environments offer the last tier of the proposed proving ground testing environment, offering AVs exposure to complex limited-access roadways with varying typical sections, ingress and egress merging operations, and construction operations. Additionally, the I-4, SR 540, and SR 528 systems offer connectivity to the Central Florida express lanes network, which offer a test environment of a network of continuous, dedicated lanes for AVs. The public roadway proving ground offers opportunities to test use cases, including but not limited to vehicle platooning (for freight and passengers), work zone safety applications, express bus operations, and highway maintenance operations.

The Bridge District in downtown Orlando is an urban park with facilities for pedestrians, bicycles, and transit lanes. It will open in 2021.

City of Orlando Central Business District (LYNX, Bus Rapid Transit)

The City of Orlando is committed to ensuring the safety and reliability of the transportation network for all users by utilizing the latest technological advances in CV and AV technology. The City will connect our regional partners by coordinating technical expertise and fostering these relationships.

Through coordination with LYNX, a third-tier open deployment testing site on the BRT route within Orlando's central business district will serve as an automated transit vehicle proving facility. The BRT route is a heavily utilized loop that serves the downtown urban core, operating on dedicated and shared transit lanes, with about 5- to 10-minute headways during business

hours. The multimodal nature of travel in Downtown Orlando consists of heavy volumes of vehicles monitored by an extensive system of sensors, traffic control systems and a Connected Transportation Management Center. A high volume of pedestrians and cyclists utilize the City's Cady Way and Orlando Urban Trail, and the City's bike-sharing program.

This urban core environment provides the ideal third tier to the open deployment testing to analyze all modes of travel experienced in downtown: vehicle, transit, freight, pedestrian, and bicycle. This environment will support additional use cases, such as automated shuttles and automated shared-use vehicles – for first- and last-mile services – to support public transportation.

MANDATORY CRITERIA

Designated Safety Officer

The Central Florida AV Partnerships' Designated Safety Officer will be FDOT District Five Safety Engineer Anthony Nosse, P.E. Nosse has served as the District Five Safety Manager for the past 18 years is the longest-serving Safety Manager in FDOT.

The safety program Nosse currently oversees is over $130 million in value over just the past five years. Nosse's technical excellence was recently recognized by his peers with the receipt of Florida Association of County Engineer and Roadway Supervisor's (FACERS) annual award. His combination of experience and technical knowledge uniquely qualifies him to serve in the role.

Commitment to Sharing and the Community of Practice

As demonstrated in the Partnership's members' previous and ongoing research and testing efforts, the concept of sharing data, results, and best practices is considered a standard practice. A major requirement of the Designated Proving Ground is an open and sharing mindset to advance automated technology, safety practices, and enhance mobility. The Partnership is, and will remain, committed to this Community of Practice.

PROPOSED CONTRIBUTIONS

Remaining open with and supportive of the Community of Practice and collaborative efforts with USDOT is an operational goal of the proposed Central Florida AV Partnership Proving Ground.

Some of the most advanced AV technology incubation and testing facilities in the world comprise the Central Florida AV Partnership Proposed Proving Ground. These facilities include a minority university, established USDOT UTC laboratories, a state-of-the-art technical university, the only dedicated high-speed AV testing facility in the southeastern United States, Interstate and Expressways, a downtown urban core, and the NASA KSC facility.

The full capabilities of these facilities are yet to be discovered and offer the ability to test and prove technologies in some of the most extreme environments possible. The Central Florida AV Partnership and its facilities have demonstrated the ability to be the leading institutions and areas for the development and innovation of AV technologies. These innovations have led to technologies that we use to better understand and handle mobility issues.

Through participation in national and global forums, our Partnership members have shared these solutions and collaborated to address issues and adapt solutions to fit a broad range of issues, furthering the Community of Practice. These demonstrated efforts show the Partnership's commitment to contributing everything that it can share.

COMMITMENT TO SAFETY

As part of its proposed AV proving ground, the Partnership will develop a detailed Safety Management Plan (SMP), which will function as a mechanism to coordinate safety efforts, engage leadership and stakeholders, collect and analyze data, determine emphasis areas for safety, identify strategies to improve safety, prioritize funding for safety projects, and evaluate their results.

Safety Management Plan

The basic elements of the SMP include the following:

- Development and implementation of the AV proving ground safety policy;
- Writing and/or compiling AV proving ground rules and practices;
- Training staff in those rules and practices;
- Delineation of safety responsibilities of team/program members;
- Discipline and incentive procedures for penalizing infractions and rewarding compliance with program rules; and
- Regular review and amendment process for program provisions, including a safety committee with compliance officers representing all partners.

Current safety procedures will be expanded to integrate policy guidance from the USDOT, but also to leverage the work done within the Community of Practice, on other USDOT programs, and within the auto industry. A functional safety and threat assessment plan will be developed. This plan will guide the execution of a functional safety and threat assessment program related to AV testing. As applicable, ISO 26262 will be used to address requirements and processes to mitigate or eliminate risks during testing of AVs. Highway design and operational standards, NEMA, and OSHA standards will apply to address risks associated with the infrastructure and electronic components, as needed.

1. **Safety Risk Process and Approach**
   a. Safety risks are identified, assessed and controlled.
   b. Team members are involved in the safety management process.
   c. Technical experts are involved in the process of identification and assessment
   d. Safety risks and control measures are monitored and reviewed.
   e. All team members, participants, contractors, and emergency response agencies will be informed of safety procedures.
   f. All equipment, software, processes, and interfaces are compliant with applicable regulations and tested before deployment.

SAFETY DEBRIEFS

The Designated Safety Officer and Program Manager will be FDOT District Five Safety Engineer Anthony Nosse, P.E. Quarterly (or as needed) safety debrief meetings will involve all Partners including:

- Designated Safety Officer
- FDOT District Five
- FDOT District One
- FTE
- City of Orlando
- NASA, KSC
- LYNX
- CFX
- Florida Poly
- UCF
- FAMU-FSU

2. **Safety Stakeholders and Existing Risk Response Plans**
   Identify parties that respond to safety incidents within proving ground deployment are and their applicable response plans including: emergency responders; operational and emergency response plans; and event planning. The Safety Program Manager will ensure these safety response stakeholders are informed on testing activities, protocols, and timeline.
3. **Safety Needs of the AV Proving Ground**
   a. Identify safety scenarios for system level/application level
   b. Construct a risk assessment including impacts, preventative measures, response plans, etc.
4. **Safety Operational Concepts**
   a. Functional safety requirements
   b. Procurement, installation, training, etc.
   c. Safety management
   d. Responsibilities, incident reporting, safety reviews, etc.
5. **Task Coordination**
   Details relationship of SMP with QA/QC, performance measures, testing, system requirements, training, etc.

Risk Management

A risk assessment will be performed for each of the safety scenarios to identify potential safety risks and analyze methods of response. An Automotive Safety Integrity Level (ASIL), defined by ISO 26262, will be determined for all identified safety scenarios in the SMP and will incorporate the following analyses, at a minimum: Analysis of Likelihood; Analysis of Potential Impact; and Analysis of Controllability

Safety Compliance Reviews

To establish a safety compliance review program for the AV proving ground, mirroring the established Federal Motor Carrier Safety Administration (FMCSA) Safety Audit, and/or the USDOT Safety Audit, will be a starting point to establish a complete program for future auditing purposes. All of these programs have proven standards established that determine a motor carrier's safety fitness, including:

- A driver's hours of service
- Vehicle maintenance and inspection
- License requirements
- Financial responsibility
- Accidents
- Hazardous material (if applicable)
- Commercial/economic regulations (if applicable)
- Safety management controls
- Operational performance
- U.S. regulatory compliance

Audit Program

An audit program will be used to evaluate performance and produce an approval or a failure document, issued to the organization, noting what corrective actions are needed for safety deficiencies. Some of safety compliance aspects that need to be determined include, but are not limited to:

- Establishing safety compliance standards;
- Creating grading system criteria to determine pass or fail aspects;
- Determining time frames between audits;
- Establishing Corrective Action Plan processes and timelines based on deficiency items; and
- Continual evaluation and documentation of lessons learned.

RESEARCH, APPLICATION AND DATA SHARING

The overall goal of the Central Florida AVs Partnership is to increase safety and transform mobility for all modes of transportation. The Partnership includes some of the leading institutions and developers of AV technology, providing the opportunity for testing in multiple environments that simulate conditions for extraordinary events. The implications and understandings that can be gathered from this type of research are invaluable to the development of best practices and planning policy to support the innovation and development of AV technology. Using agency and jurisdictional partners, the disseminated testing results, conclusions and best practices can be shared via agency channels throughout the State of Florida.

The results can also be easily shared through our Partnership members' affiliations with national transportation research institutions such as USDOT, TRB, NCHRP AASHTO, ITS America, IBTTA, and others. This Partnership will remain committed to the common goal of procuring the understanding of the technology as it develops into the future.

Leading Central Florida academic institutions have agreed to join the Partnership to further expand the capabilities of the proving ground. Florida Poly is working with FDOT, FTE and SunTrax to provide comprehensive testing scenario for both software, hardware and physical objective testing. As part of the Partnership's research and extension resources available to carrying out programs to advance AV technology, Florida Poly is proposing a comprehensive scenario testing solution which has the following properties:

- **Realistic Input:** Using existing video streams, Florida Poly will be able to seed realistic test generation engines using core game engine technology.
- **Pseudo-Random Test Generation:** Using realistic seeds, Florida Poly technology can build pseudo-random test scenarios which can not only accelerate the test generation process, but generate tests without the bias typically involved with manual test generation.
- **Data Mining:** Using data mining, Florida Poly can automatically determine mean "good" behavior based on a statistical population drivers, thus deriving the criteria for success. This is a technique used in natural language processing systems.
- **Successful Coverage Analysis:** Using signature analysis, these test scenarios can be cataloged and tracked. This capability provides regulators with a framework to start setting up certification test suites for vehicles.
- **Invariant to Test Setup:** The unit under test, in this environment, can be a real car (hardware-in-loop or stimulator), a simulation model of the vehicle, or even just the sensor systems.

This innovative flow combines experience Florida Poly has in fields such as game design, vision processing, hardware verification and coverage analysis. The benefits and positive characteristics of this technology for the Community of Practice and USDOT include:

1. **Complementary to Physical Track and Simulation Investments:** Florida Poly's technology is complementary to Physical Track investments that can be used for characterization and diagnostics purposes for the generated scenarios.
2. **Regulatory Framework for Certification:** For the first time, regulators can have a language for measuring scenario coverage. In addition, automakers will have knowledge of whether their various generations of vehicles actually improve safety. That is: Is the next generation at least as good as the previous version?
3. **Growing Knowledge Base:** Finally, accidents will still occur, but this system has the capability for absorbing new test cases as seeds and automatically build related situations in an automated fashion.

BENEFITS OF SCENARIO TESTING TECHNOLOGY

Complements physical track investments, which can be used for characterization and diagnostic purposes for the generated scenarios.

Regulators will have a language for measuring scenario coverage, and automakers will know whether their vehicles get safer with each generation.

Accidents will still occur; however, the system absorbs new test cases as seeds and automatically builds related situations.

The institution will also be able to assist on-site at SunTrax to help realize and disseminate controlled track testing. The UCF Transportation Lab offers one of the few USDOT UTC simulation centers for further software and hardware testing. NASA Swamp Works lab will provide hardware tests in the world's only calibrated extreme environment replication chamber.

The Partnership further understands the necessity to disseminate the results obtained on the proving ground. The institutional and agency members would be able to provide these results via established channels and into public technology education programs. These programs exist at Florida's many technical institutes, colleges, and universities. The education component of our goal extends to decision makers to allow for a clear and concise understanding of the sociological and ethical impacts that may result from the objective tests at our proving ground.

As previously mentioned, The Partnership will collaborate with the Community of Practice. The further development and innovation within the AV realm relies on this principle. Several of our partners have established policies to make data open and readily available for use. These platforms are expanding every day and will be adapted into the partnership.

DEMONSTRATED INVESTMENTS

Intelligent Transportation Systems (ITS) operators with FDOT Districts One and Five, FTE and CFX have built out extensive infrastructure. For the subject corridors, an extensive system of ITS infrastructure for freeway traffic management operations is already in place offering the proving ground the following capabilities and safety features:

- Continuous fiber optic communications including a 10-gigabit Ethernet network capable of supporting data requirements for CVs, vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V)applications;
- Fiber throughout City and BRT network;
- Cameras approximately every mile providing full visual coverage;
- Point speed detectors placed approximately every half-mile;
- 24/7 traffic management center operations;
- Ubiquitous probe vehicle data from transponders, HERE, and Waze are continuously communicating in real-time across agency owned, operated and maintained fiber optics;
- Road Ranger service patrols;
- Dedicated Florida Highway Patrol enforcement ;
- Dynamic message signs; and
- AV identification-based travel time system.

The existing proving ground infrastructure will provide data and the ability to observe the reaction of vehicles sharing the roadways with the AVs, and provide historical data all provided via an existing interface.

FDOT Districts One, Five, FTE and CFX also have extensive information technology (IT) capabilities. Districts One and Five have dedicated ITS IT staff while CFX and FTE have joint ITS and tolling staff. This group of experts have worked independently and collaboratively to design and construct the existing ITS and tolling infrastructure that operates Florida's roadways. This includes cyber security, ethernet and serial based communication networks, SCADA, custom software development, virtual servers, extensive system testing and integration in 24/7/365 systems, and build on with active/active redundancy. To accomplish this the teams have been built on an approach that minimizes staff via technology with human oversight for exceptional events. The Partnership's technical staff have the capability to design, execute, and manage the proving grounds infrastructure securely – with exceptional uptime and minimal staffing resources – with a wide variety of potential technologies.

SR 528: FREIGHT/TRUCK TEST CORRIDOR

A subset of the SR 528 and I-4 system is the freight corridor from Orlando International Airport freight logistics center to Port Canaveral. This section of roadway offers the ability to test freight AV technology in a real-world environment. FTE is beginning an AV pilot project on SR 528 to test driver-assisted truck platooning technology. This testing will advance understanding about safe headways, V2V and V2I communication, efficiency, mobility, safety and fuel consumption.

In 2012 Florida House Bill 1207 was passed, allowing the licensed and insured testing of AVs on all of Florida's public roadways. This policy was updated based on USDOT, FHWA, and NHTSA interim guidance and policy to reflect best practices for State Models. House Bill 7027, passed in July 2016, amends provisions of House Bill 1207 to allow for the testing of platooning freight vehicles and the operation of an AV without a driver present.

This legislation has allowed the Central Florida region to participate, successfully complete, and continue to develop AV technology pilot projects. Many of these projects are in conjunction with the FAV program such as:

- Navigation Pilot Rental Program – TravTek (1992)
- Connected Vehicle Affiliated Testbed along I-4 (2011)
- Driver Assisted Truck Platooning Pilot Project on SR 528 (2017)

READINESS

The Central Florida AV Partnership's proposed proving ground consists of multiple existing and planned facilities. With the exception of the state-of-the-art SunTrax facility and the I-4 Ultimate project, we are ready to continue our research and testing efforts today as a USDOT-Designated AV Proving Ground.

> "The Central Florida region is not new to AVs. The agencies involved in this Partnership have extensive experience in the research and development of AVs, and jurisdictions have been actively involved with incorporating the future of AVs into decision-making processes."

The Partner facilities mentioned previously have worked with multiple government agencies and private manufacturers to understand and objectively test software, hardware and AV deployments in a range of operating conditions. And as such, the testing results were always shared with the Community of Practice to help support innovation and education. The Partnership remains committed to this approach and hopes to inspire other testing communities to grow and share as well. Each Partnership member will participate in regularly scheduled collaboration meetings to coordinate efforts, update safety reviews, and continue to develop the proving ground. The assigned points of contact, **Michael Shannon** and Charles Ramdatt, will report to USDOT and its relevant research offices on the status of the proving ground and regular agenda items.

The Central Florida region's Smart City efforts have brought a wealth of knowledge, vision, and innovation to the Central Florida area. These communities have been actively seeking solutions to emerging mobility issues involving AVs.

ADHERENCE TO LAWS, REGULATIONS AND FEDERAL POLICY

The Central Florida region has supported the state's mandate toward the use and operation of technologies. With the recent release of the new Federal Automated Vehicles Policy, the Partnership has understood that the State is prepared to adopt the ideal State Model as proposed by USDOT and NHTSA. Per Florida law, AVs must comply with all federal, state and local regulations and permitting processes when testing on public roadways. Compliance testing and objective testing to perform to, and beyond standards, such as International Standards Organization (ISO), and SAE International, can be performed in both the simulation/laboratory facilities and controlled facilities.

The Central Florida AV Partnership is excited to present this application for its designation as a AV proving ground. This Partnership is committed to build upon our relationships with USDOT and support a rapidly growing and innovating Community of Practice.

Demonstrated Proven Safety Practices and Plan	✓
Dedicated to Sharing Results, Data and Findings	✓
Unparalleled Research Capabilities and Opportunities	✓
Committed to Supporting Education for Agencies and Institutions	✓
Extensive Capital Investments to Support AV Advancements	✓
Eligible Facilities	✓
Proving Ground Ready Today	✓
Compliant with USDOT, FHWA, NHTSA and State Policy	✓

APPENDIX CONTENTS:

LETTER OF PARTNERSHIP AND SIGNATURES

LETTER OF PARTNERSHIP FROM NASA, KENNEDY SPACE CENTER

LETTER OF COMMITMENT AND SIGNATURES

December 19, 2016

United States Department of Transportation
Office of the Secretary
1200 New Jersey Ave, SE
Washington, D.C. 20590

SUBJECT: Solicitation of Proposals for Designation of Automated Vehicle Proving Grounds Pilot
Docket No.: DOT-OST-2016-0233
Endorsement and Commitment to the Teaming Partners and USDOT for the Designation of the Central Florida Automated Vehicle Proving Ground Pilot

To the US DOT Office of the Secretary:

Central Florida is proud of our collaboration and creative thinkers, building on the success of our industry clusters, from tourism to modeling and simulation to further diversify our economy and create new hubs of industry that have generated high-tech, high-wage careers for our residents in cutting edge industries.

Through this regional strength, we have also found a way to bring game-changing projects to our community, connecting our residents to opportunities and the jobs of the future in things like SunRail, the Medical City at Lake Nona and a shared UCF/Valencia Campus in Downtown Orlando.

In that spirit, we seek to take advantage of our unique community partnerships, resources and talents in academia, private sector and government agencies to establish the nation's premier cluster for research and development of AV technology across all modes of travel.

Each of our partners is renowned for its innovation and technology in providing excellent public service, for improving the body of knowledge in a variety of fields and for making communities more livable. We seek to draw on these experiences and talents to further create synergy which will significantly advance safety, reliability and sustainability for all modes of travel.

We are excited to have this opportunity to showcase our talents, resources and our premier location for the facilitating of continuing advances to state-of-the-art in mobility.

Sincerely,

Committed Partners to the Central Florida Automated Vehicle Proving Ground Network

CITY OF ORLANDO
City of Orlando Mayor Buddy Dyer

FLORIDA POLYTECHNIC UNIVERSITY
Florida Polytechnic University President Dr. Randy K. Avent

UCF UNIVERSITY OF CENTRAL FLORIDA
University of Central Florida President Dr. John C. Hitt

COLLEGE OF ENGINEERING
FAMU-FSU College of Engineering Dean J. Murray Gibson, PhD

CENTRAL FLORIDA EXPRESSWAY AUTHORITY
Central Florida Expressway Authority Executive Director Laura Kelley

FLORIDA'S TURNPIKE
Florida's Turnpike Enterprise Executive Director and CEO Diane Gutierrez-Scaccetti

FDOT DISTRICT 5
FDOT District Five Secretary Noranne Downs, P.E.

FDOT DISTRICT 1
FDOT District One Secretary L.K. Nandam

LYNX
LYNX Chief Executive Officer Edward L. Johnson

National Aeronautics and Space Administration
Kennedy Space Center
Kennedy Space Center, FL 32899

December 19, 2016

The Honorable Buddy Dyer, Mayor
City of Orlando
400 South Orange Avenue
Orlando, FL 32801

SUBJECT: Support for the City of Orlando's Application to Receive Automated Vehicle Proving Ground Designation

Dear Mayor Dyer:

The purpose of this letter is to offer the National Aeronautics and Space Administration (NASA), Kennedy Space Center's (KSC's) support for the City of Orlando's application to receive Automated Vehicle Proving Ground Designation. This project holds the potential to benefit KSC by promoting advanced technologies that may have NASA mission related applications. Should the City of Orlando succeed in receiving the requested designation, KSC is committed to exploring all possible partnership opportunities to ensure the project's success.

Should KSC and the City of Orlando enter into a partnership agreement for this effort, the KSC facility could provide safe and closed areas for testing several types and modes of transportation. Many of our facilities are already used for similar cutting edge research and development purposes.

Under such a partnership agreement, KSC might also be able to offer its unique testing capabilities, technical staff, instrumentation, processes and technical expertise. Such services would allow for a collaborative and open testing environment to better promote safety and yield optimal development of automated vehicle technology. Our ability to better understand and test advanced sensor systems, in both laboratory and real world environments, under the most extreme conditions, in which vehicles, of all types, and pedestrians, would be able to operate, could provide invaluable data in setting safety, operations, and equipment standards.

If you require further assistance in this matter, please do not hesitate to reach Amy Houts Gilfriche at 321-861-3924 or via e-mail at <Amy.M.HoutsGilfriche@nasa.gov>.

Sincerely,

Thomas O. Engler
Director, Center Planning and Development

To the US DOT Office of the Secretary:

Central Florida has many unique attributes for an AV proving ground that set us apart as the premier location for this designation. Our region includes state-of-the-art high-tech facilities and committed local and state governments, working together to further the safety and use of AV technology on our streets to create a more sustainable community.

The Central Florida region has developed a committed team of quality educational institutions and laboratories – including Florida Polytechnic University, the University of Central Florida, and Florida Agricultural and Mechanical University-Florida State University – where AV technology will continue to be developed, refined and simulated. This proving ground offers controlled testing environments and laboratories at NASA and the new state-of-the art SunTrax facility – a purpose-built facility for the controlled testing of tolling and AV technology. Our final team members include FDOT and City of Orlando's local and regional transportation networks that provide a continuous network of roadways that allow for live AV deployment. The Central Florida proving ground offers testing environments include all modes of transportation including pedestrian, bicycle, transit, passenger vehicle and freight.

Our community joins together to draw from the strengths of each committed partner to provide a versatile network for the AV proving ground that includes all phases in the testing process from simulations, controlled testing and deployment.

As major stakeholders within the region, we pledge our commitment to:

- Comply with an overall Safety Management Plan.
- Maintain a working relationship and share lessons learned with the USDOT and its research program offices, and the Community of Practice.
- Provide access to all data produced in the Central Florida AV Partnership Proposed Proving Ground.

We are confident that our strong partnership will bring an unprecedented advancement to safety, testing and AV technologies to the transportation industry.

Sincerely,

Committed Partners to the Central Florida Automated Vehicle Proving Ground Network

metroplan orlando
A REGIONAL TRANSPORTATION PARTNERSHIP

Metroplan Orlando Executive Director Harold W. Barley

ORANGE COUNTY FLORIDA

Assistant Orange County Administrator James E. Harrison, Esq., P.E.

GREATER ORLANDO AVIATION AUTHORITY

Greater Orlando Aviation Authority Executive Director Phillip N. Brown

FDOT

Florida Department of Transportation Secretary Jim Boxold

OSCEOLA COUNTY FLORIDA

Osceola County Manager Don Fisher

POLK COUNTY

Polk County Commissioner, District 2, Melony M. Bell

SPACE COAST TPO

Space Coast Transportation Planning Organization Executive Director Bob Kamm