

**DRAFT EXHIBIT “A”, SCOPE OF SERVICES
FLORIDA DEPARTMENT OF
TRANSPORTATION DISTRICT FIVE
AUTONOMOUS SHUTTLE FOR
UNIVERSITY OF CENTRAL FLORIDA
CAMPUS**

I. PURPOSE

The Florida Department of Transportation (FDOT), specifically District 5, is seeking information from vendors related to a turnkey solution providing autonomous vehicle (AV) shuttle operation on the main campus of University of Central Florida. This turnkey solution shall include, but is not limited to, the procurement of all vehicles, the furnishing and installation of all required infrastructure related to electrical charging and vehicle operation, as well as continued operations and maintenance responsibilities throughout the duration of the contract. This RFI addresses the deployment of AV technologies and proposed operation and maintenance strategies. A successful RFI response will include only AV technologies as a design consideration.

The intent of this RFI is to determine the feasibility of AV shuttle services on UCF campus; to analyze options and vendor strategies for successful, cost-efficient operation; and, to determine qualified vendors capable of the development, implementation, operation, and maintenance of AV technologies.

Founded in 1963, the University of Central Florida (UCF) is an emerging preeminent research university located in metropolitan Orlando, Florida. With more than 66,000 students, UCF is one of the largest public state universities in the nation. The 1,415-acre main campus is located 13 miles east of downtown Orlando, adjacent to one of the top research parks in the country. In addition to the main campus, UCF also maintains eleven regional campus locations throughout Central Florida and a fully accredited College of Medicine in the Medical City at Lake Nona.

A. Campus Design

- a. Designed to be a pedestrian oriented campus, UCF is comprised of a series of four concentric circles: Gemini Boulevard, Apollo Circle, Mercury Circle, and Pegasus Circle. The outermost campus ring, Gemini Boulevard, also serves as the main roadway for vehicular traffic on campus. Inside of Gemini, exclusive pedestrian-access rings, Apollo Circle and Mercury Circle, provide circuitous paths between various academic and student-life buildings. Pegasus Circle, the innermost ring, contains the Student Union situated at the very heart of campus and offers space for students and members of the UCF community to study, socialize, eat, host events, attend meetings, and engage in campus life.
- b. All academic buildings are positioned inside of Gemini Circle, with the circle divided into smaller sections for each college. Conversely, student housing is provided along the perimeter of campus separated into various themed sections, including Greek Park to the northwest, Knights Plaza and athletic facilities to the north, the Arboretum to the east, and student recreation and wellness facilities to the south.



Figure 1: University of Central Florida main campus design consisting of four concentric circles: Gemini Boulevard, Apollo Circle, Mercury Circle, and Pegasus Circle.

B. Pedestrian Access Facilities

- a. Throughout campus, pedestrian access facilities provide UCF students, faculty, staff, and visitors pathways between academic buildings, student housing centers, and other on-campus facilities. Radiating outward from the center of campus and the Student Union, three primary pedestrian access facilities encircle the campus: Pegasus Circle, Mercury Circle, and Apollo Circle. While primarily for pedestrians, on-campus sidewalk facilities are commonly shared amongst pedestrians, bicyclists, and occasional electric maintenance vehicles.
- b. Encircling the Student Union, Pegasus Circle is comprised of public-access surface streets with 8' sidewalks on either side of Pegasus Drive and Aquarius Agora Drive, connected by an exclusive pedestrian pathway of brick pavers bordered by concrete sidewalks. Pegasus Circle provides access between the Student Union, College of Science, Business Administration, Engineering, Health and Public Administration, Business, and Burnett's Honor College, as well as the Memory Mall greenspace.
- c. Encompassing Pegasus Circle, Mercury Circle is an exclusive pedestrian-access sidewalk providing a continuous radial connection between the Memory Mall, Colleges of Psychology, Communications, Visual Arts, Technology, Chemistry, and Biology, John C. Hilt Library, J.T. Washington Center, and various parking facilities. Pathways along Mercury Circle vary in width of sidewalk from 8' to 20' with numerous diagonal spurs entering and exiting the circular avenue, as well as surface street crossings at Scorpius Street and Aquarius Agora Drive.

- d. Further from the center of campus, Apollo Circle is an exclusive pedestrian-access sidewalk providing a continuous pathway about campus with two surface street crossings at Scorpius Street and Aquarius Agora Drive. Apollo Circle connects Millican Hall—a focal point of campus—with the Alumni Center, Colleges of Health and Pharmacy, Physical Sciences, Optics, Arts and Humanities, and Education, as well as various student residential complexes and numerous facilities. Apollo Circle maintains a constant sidewalk width of 18', providing the largest radial connector on campus.
- e. Bordering Greek Park Drive and Gemini Boulevard, two 6' sidewalks circumnavigate the interior of campus on either side of the roadway, except for in a few select locations. These parallel pathways provide a continuous radial connection between the University Welcome Center, Recreation and Wellness Center, Knights Plaza, Memory Mall, Greek Park, and various parking facilities including Visitor Parking. This exclusive pedestrian-access facility includes thirteen signalized intersections and three non-signalized, mid-block pedestrian crossings.
- f. Exclusive pedestrian-access facilities also connect the Student Union and Pegasus Circle with the Knights Plaza commercial area housing the CFE Arena, across what is known as Memory Mall. Concrete sidewalks bordering Memory Mall are 16' in width and terminate in two signalized intersections across Gemini Boulevard. Within Knights Plaza pedestrian facilities vary in width from 8' to 16' dependent upon location.
- g. Refer to **Appendix A** for additional information related to on-campus pedestrian facilities.

C. Parking Facility

- a. UCF offers a wide variety of parking facilities and services for students, faculty, staff, and visitors on campus. Parking facility access is determined by permit, which can be obtained through the UCF Parking and Transportation Services. Student permits are subdivided into commuting and on-campus residents with four permissions determining which facilities a student may occupy: "D", "R", "RL", and "KP" permits. Similar, faculty permits are subdivided into three permissions: Reserved "A", "B", and "C" permits. Visitors seeking to park on campus in non-metered locations must first obtain a Visitor Permit from the Visitor and Parking Information Center. Disability and Motorcycle parking permits are also available for qualified individuals, with designated parking facilities scattered throughout campus.
- b. Both surface lot and vertical garage parking facilities are provided on campus, located within the interior and along the outskirts of campus. Over 30 surface lots offer available on-campus parking. Lots may be either dedicated permissions or mixed-use with designated stalls determined by signing. Access permission to surface lots may vary depending upon the time of day, allowing for increased access after-hours or overnight.
- c. UCF also offers students a Park and Ride shuttle service between student and on-campus resident Lot E4, located south of the softball stadium on the fringe of campus, and the interior of campus.
- d. In total, ten vertical parking garages are provided on campus, positioned along the primary motorist travel ways around campus, Gemini Boulevard and Libra Drive, and within the Knights Plaza commercial area. Within the interior of campus, there are six garages available to students and on-campus residents. Similarly, two dedicated parking garages within Knights Plaza offer parking to on-campus residents specific to the Towers residence halls. Located behind the CFE Arena, positioned at the heart of both Knights Plaza and the university athletic complexes, sits one dedicated parking garages for events.
- e. Users of the on-campus garages are limited to vehicles with vertical clearances equal or no greater than 7'-0". Motorists are able to check the availability of parking spaces in the on-campus garages through the UCF Parking and Transportation Services website (<http://secure.parking.ucf.edu/GarageCount/>).

- stations are permitted a four-hour maximum charge as long as a valid UCF parking permit is displayed.
- g. Refer to **Appendix B** for additional information related to on-campus parking facilities.

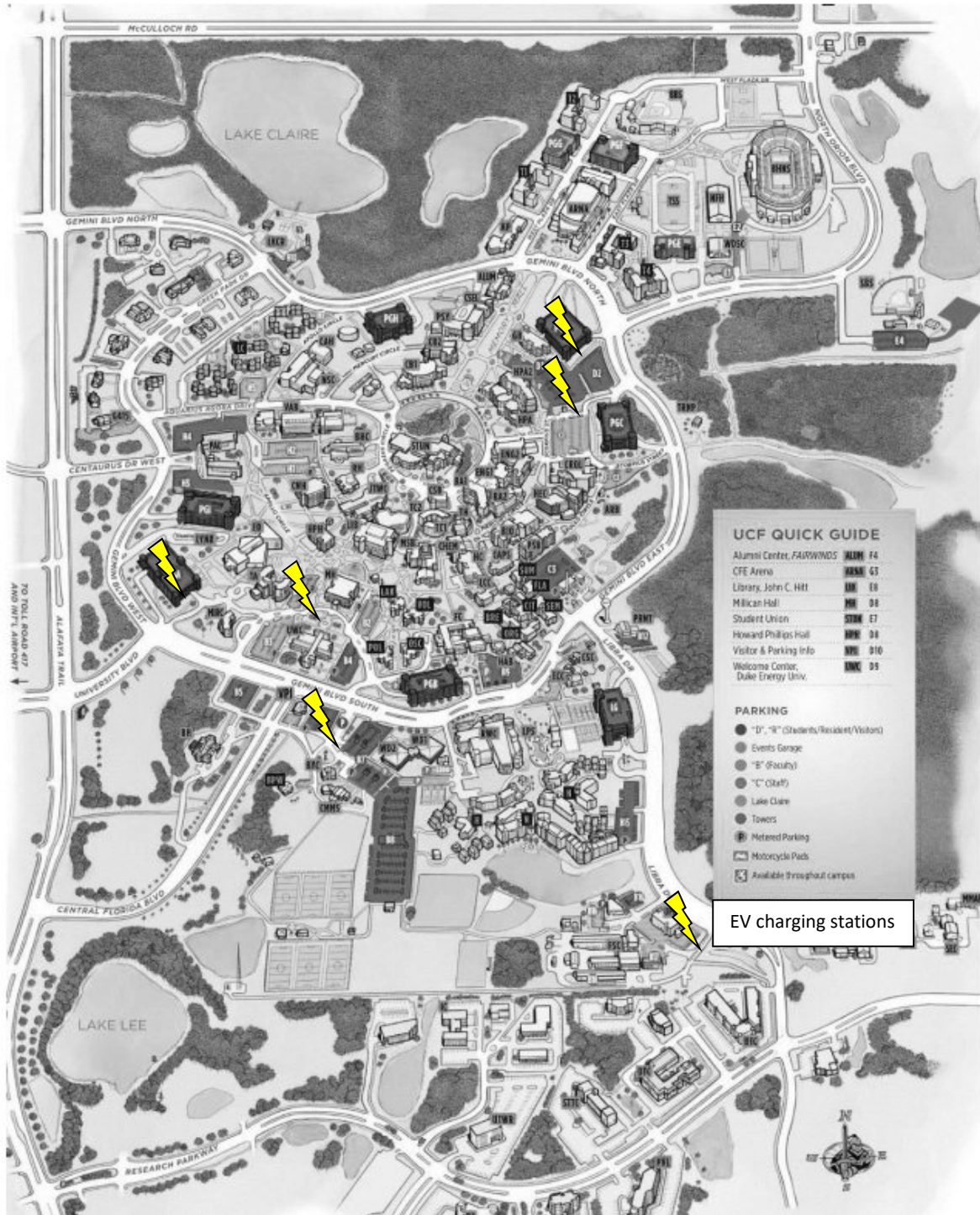


Figure 3: Parking facilities offering electric vehicle charging stations.

D. Student Transit Services

- a. Providing service for students to move about campus, as well as between campus and student residential communities, UCF offers multiple on and off-campus shuttle routes. Two on-campus routes, the Black and Gold, provide shuttle operations between academic buildings and student resource facilities circumnavigating Gemini Circle. Typical operations during the Fall and Spring semesters involve four shuttles running between 7:00 am and 7:00 pm traversing between eight (or nine, Black route only) designated stops. During the Summer semester, Black and Gold route operations are reduced to two shuttles running between 7:00 am and 4:00 pm.
- b. Effective August 20, 2018, the on-campus shuttle system will be renamed as the Pegasus Express and will revise operations to serve 11 designated stops while maintaining hours of operation.
- c. In addition to on-campus shuttles, UCF offers multiple off-campus shuttle routes connecting students to satellite campuses, as well as affiliated and non-affiliated student apartments, residential centers, and other off-campus entities from various main campus locations. In total, 15 off-campus routes are provided connecting students with the surrounding Orlando area.
- d. All on and off-campus transit services offered to students, faculty, and staff are provided by a third-party entity, under contract through June 2020. This third-party transit provider is responsible for all tasks related to vehicle procurement, re-fueling, maintenance, day-to-day operations, and overall program management. No facility dedicated to transit vehicle re-fueling or maintenance efforts exists on campus; the third-party entity maintains an off-campus facility nearby off Forsyth Road in Orlando, Florida.
- e. Refer to **Appendix C** for additional information related to campus transit services.

II. SERVICES

FDOT District 5 is interested in providing fully autonomous shuttle service capable of transporting students, faculty, staff, and visitors between various locations within the UCF main campus in Orlando, Florida. Shuttles shall occupy pedestrian-access facilities throughout the center of campus, maintaining the ability to safely operate with pedestrians, bicyclists, and smaller electric motor vehicles. Maximum operating speed for shuttles shall not exceed 15 miles per hour on pedestrian-access facilities. Additionally, shuttles shall be capable of vehicle-to-infrastructure (V2I) communications allowing for safe vehicle crossings at signalized intersections on campus.

Proposed routes will focus on transporting riders from parking and student facilities located on the outskirts of campus to more centralized locations, as well as providing transportation between key locations within the center of campus.

A. Autonomous Shuttle Service

- a. Vendors shall provide accommodations for one vehicle to service each existing, expansion and/or proposed route - as based on item 10 - for the entirety of the hours of operation.
- b. Minimum hours of operation shall be structured around providing service to the highest concentration of potential riders, namely students, during the morning, midday, and evening classes hours. Shuttles shall operate on week days, Monday thru Friday, between the hours of 9:00 AM and 10:00 PM, and reduced operations shall be provided on Saturday between the hours of 9:00 AM and 5:00 PM. Presently, no operations are planned for Sunday.

- c. In order to operate an autonomous shuttle on the UCF campus, FDOT is seeking qualified and experienced parties capable of providing full turn-key solutions. Successful responders will be responsible for procurement and delivery of necessary shuttles; performance of operations, upkeep, re-charging, and maintenance tasks; handling of business and administrative related duties; and other tasks associated with the operation of autonomous shuttles on campus.
- d. Additionally, this deployment will provide valuable data sets for university research on connected and autonomous vehicles, as well as research opportunities to study public attitudes towards automation in transportation and the safety benefits of similar transportation modes and services. Vendors shall be willing to cooperate in the exchange of data, participation in research, and testing, development, and analysis of new applications, in conjunction with the UCF Department of Civil, Environmental, and Construction Engineering and other partners.

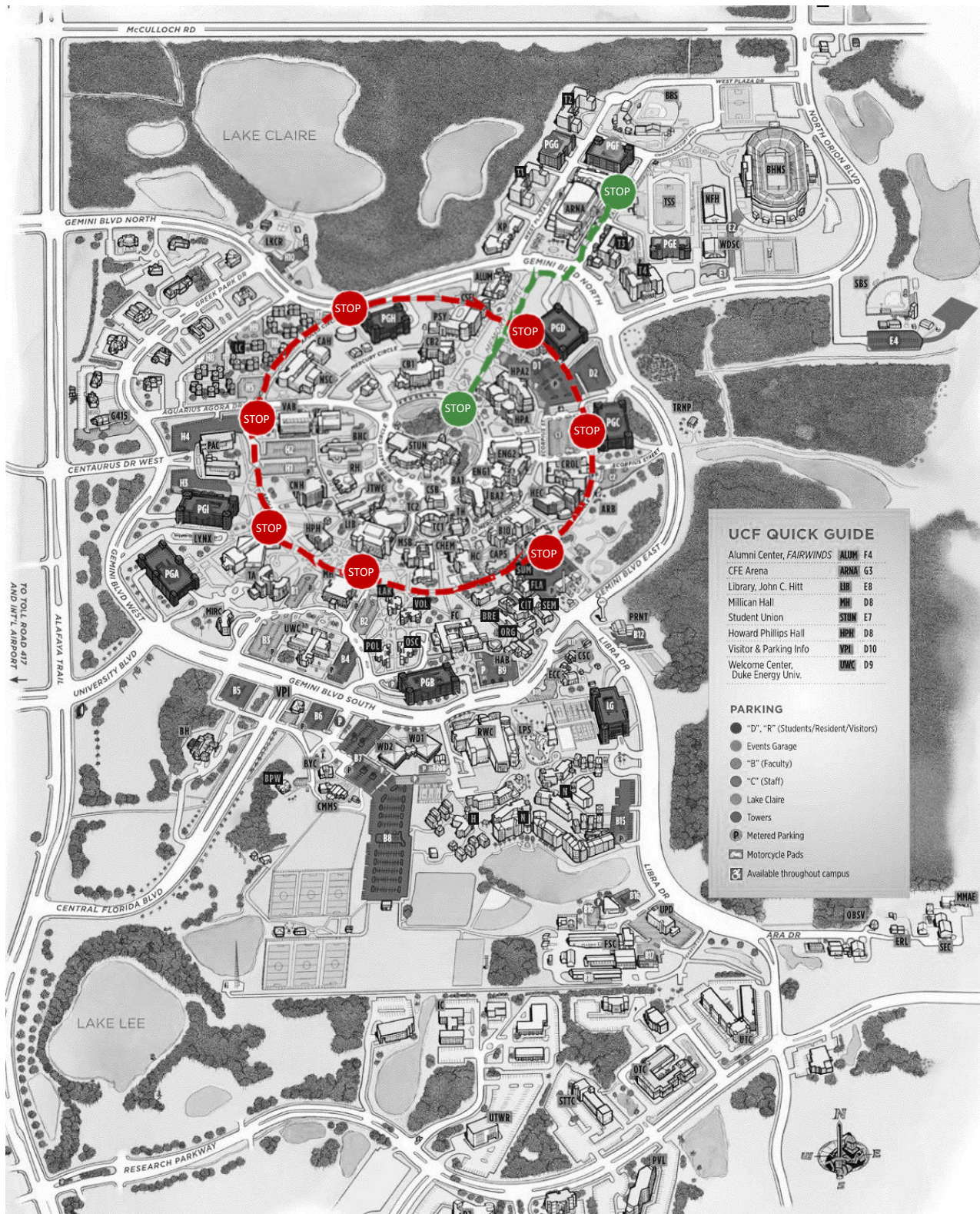


Figure 4: Proposed routes for autonomous shuttle on UCF: (Green) from Knights Plaza/CFE Arena and Student Union, (Red) Apollo Circle.

ENCLOSURE 1
TECHNICAL REQUIREMENTS

I. MINIMUM REQUIREMENTS FOR AUTONOMOUS SHUTTLE

Listed below are the minimum requirements for each autonomous shuttle deployment on UCF campus:

- A. Vendor shall provide vehicle self-certification for the Federal Motor Vehicle Safety Standards (FMVSS) and the Highly Automated Vehicle (HAV) system consistent with the US DOT fifteen- point assessment for deploying automated vehicle technologies.
- B. Vehicle shall provide autonomous navigation Level 4, or better, in accordance with the latest standards set forth by the Society of Automotive Engineers (SAE) International Standard J3016.
- C. Vehicle shall be electrical propulsion, with the ability to operate and be charged without wireline infrastructure.
- D. Vehicle shall be capable of the same level of bi-directional navigation, requiring no specific turnaround infrastructure at route termini.
- E. Vehicle shall be capable of autonomous operation in various weather and atmospheric conditions that may limit sensor performance including, but not limited to, rain, hail, fog, wind, and smoke. Central Florida maintains extreme seasonal variation in rainfall with greatest chances of rainfall between and inclusive of June through September.
- F. Vehicle shall be capable of operation in temperature ranging from -10° to 110° Fahrenheit.
- G. Vehicle shall have electrically operated access doors for passenger entry and egress.
- H. Vehicle shall be capable of 4G, or better, cellular/wireless connectivity with the ability to stream live video and other real-time data feeds for remote management and vehicle operations.
- I. Vehicle shall incorporate a two-way communicator capable of live communication between passengers inside the shuttle and the remote management center.
- J. Vehicle shall be capable of V2I, V2V, and V2X communications through dedicated short-range communications (DSRC) methods.
- K. Vehicle shall be capable of receiving, at a minimum, signal phase and timing (SPaT) and physical geometry (or MAP) messaging, and interpret the message for analysis and decision-making from roadside units (RSU).
- L. Vehicle shall be compliant with Wireless Access in Vehicular Environment (WAVE)/Institute of Electrical and Electronics Engineers (IEEE) Standard 1609, SAE Standard J2735 DSRC Message Set Dictionary, and Web Content Accessibility Guidelines (WCAG) Standard 2.0.
- M. Vehicle shall include a display to host real-time Automatic Vehicle Location (AVL) data stream consistent with the existing UCF Shuttle Locator desktop and mobile application (<https://ucf.crystal-tod.com/rider/>).
- N. Vehicle shall provide the appropriate cybersecurity safety measures necessary to deter and prevent attempted access by outside parties for the purpose of gaining vehicle controls, modifying system operations, or otherwise accessing data governing or associated with autonomous vehicle control systems.
- O. Vehicle shall provide the ability for mobility impaired passengers to board and alight the vehicle safely at designated stop locations.
- P. Vehicle shall include electrically-operated access doors for passenger entry and egress. Doors shall automatically default to open in the case of an operational failure or power outage. Manual door release shall be incorporated if automatic default open function unavailable.
- Q. Vehicles shall include a climate controlled interior. Air conditioning units shall maintain interior temperature during cooling months no higher than 75° Fahrenheit, and no heating no less than 65° Fahrenheit during heating months.
- R. Vehicle shall include both visual and audible internal next stop announcements in English and Spanish.

- S. Vehicle shall provide the ability for customization of appearance, including vehicle wrap with space to identify project partners or commercial advertisement.

II. INFORMATION REQUESTED

In addition to the minimum technical requirements, vendors are requested to provide the following information pertaining to their autonomous vehicle technology, operational strategies, and potential cost-saving measures.

- A. Provide the options available to the Department for vehicle procurement (e.g. purchase, lease, lease-to-own).
- B. Provide schedule of operation for the proposed route(s), inclusive of minimum number of vehicles required and available service operation mode and frequency options.
- C. Provide operational procedure(s) to achieve the minimal risk condition following a system failure or operational anomaly.
- D. Provide concept of operations for autonomous shuttle, including risk and mitigation plan.
- E. Provide the generation of the following systems:
 - a. Object and Event Detection
 - b. Navigation
 - c. Chassis and Drive
- F. Provide plan for minimum cybersecurity countermeasures.
- G. Provide specifications related to autonomous vehicle technology; e.g. systems, sensors, electrical propulsion, battery life and replacement, passenger capacity and interior features.
- H. Provide details, specifications, and available options for electrical charging infrastructure platform(s) and necessary existing infrastructure.
- I. Provide information related to additional infrastructure that may be required for autonomous vehicle operation, e.g. ancillary ground-mount sensors.
- J. Provide information on the procedures for modifying and expanding existing routes, or creating new routes.
- K. Provide details on software suites and/or mobile applications provided as a component of vehicle operations.
- L. Provide best practice information related to storage of vehicles and systems.
- M. Provide details on the infrastructure required, e.g. additional sidewalk, curb ramps, railing, etc., necessary to ensure ADA compliant shuttle stops.
- N. Provide information on the ability of the vehicle and sensor arrays to operate safely in severe weather and limited visibility conditions. Additionally, describe how vehicle will determine whether or not safe operation is achievable, and how vehicle will respond to severe weather conditions if/when encountered during operation.

ENCLOSURE 2
DISTRICT 5 SITE LOCATIONS

- A. Operation between the CFE Arena/Knights Plaza and the Student Union
 - 1. Stop No. 1 – CFE Arena in Knights Plaza
 - 2. Stop No. 2 – Student Union/Pegasus Circle
- B. Operation around Apollo Circle, with designated pick-up/drop-off at the following locations:
 - 1. Stop No. 1 - Memory Mall/Parking Garage D
 - 2. Stop No. 2 – College of Optics and Photonics (CREOL)/Parking Garage C
 - 3. Stop No. 3 – College of Physical Sciences (PSB)/Parking Lot C3
 - 4. Stop No. 4 – Millican Hall (MH)
 - 5. Stop No. 5 – College of Education (ED)/Parking Garage I
 - 6. Stop No. 6 – Visual Arts Building (VAB)/Parking Lot H4
 - 7. Stop No. 7 – Parking Garage G