Beyond Traffic: The Smart City Challenge

A new **New Orleans**

A Model for Innovative and Equitable Mobility

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A new **New Orleans**

A Model for Innovative and Equitable Mobility

New Orleans has always been at the forefront of change. From its French settlement to its Spanish concession, from its reconnection to the French Republic to its purchase into the Union, New Orleans has continually adapted and reinvented itself. Whether through the changing political landscape of its history or from forces of nature like Hurricane Katrina, we have demonstrated great resilience, rising to meet the challenges before us. A major port city, jobs center, and international tourist destination, our city blends a topography that traverses sea level with an urban tapestry of historic narrow streets weaving emblematic buildings, music, cuisine and art. As we approach our 300th anniversary, signs of progress are everywhere. Population is growing, business is booming and universities are expanding. We are building a new airport, redeveloping our storied riverfront and creating a 21st century medical corridor. Levels of civic engagement are the highest ever. In parallel, a key challenge is to build the technical and data infrastructure that will enable new mobility services, modes, and applications. We want to pioneer new solutions for mobility that improve convenience, equity, congestion and quality of life. Our proposed projects are vital to accelerating our progress toward becoming a well-connected, data-driven city that is a model of sustainability – a Smart City.

Our Vision

Imagine this: a city where every job is accessible and every destination reachable. Imagine a city where the dignity of every individual is respected not just in terms of equal access but also in terms of the respect for an individual's time. Imagine a city whose citizens move seamlessly across every conceivable mode of transportation. Imagine a city where free will and informed choice are made possible through technology. Imagine a city where delivery of goods is expertly and efficiently coordinated. This is what we imagine for New Orleans.

We are a city that has reinvented itself over and over—sometimes by necessity, as in the wake of Katrina's destruction a decade ago, or often through the tenacity of our community to want something better like the reform of our education system. We have proven ourselves as a reliable partner, capable of achieving the impossible. Now we have set our sights on demonstrating to the country and ourselves a better and smarter vision for improving our community and our quality of life.

A Smart City meets its challenges of congestion, mobility, capacity, air quality and safety not simply by building more, but by building smarter. We propose to build a powerful data gathering infrastructure that will enable a platform we call the Urban Operating System upon which we will build a host of new mobility services, modes, and applications.

This new infrastructure will serve our two cities simultaneously: a city of residents, 384,000 strong, and a city of visitors occupying the 35,000 downtown hotel rooms and thousands of cruise ship cabins. Like two sides of the brain each must work in concert with the other. The residents focus on their daily commute, their social interactions and the needs of everyday living. Our visitors, ready to have fun, navigate through a city of which they may have little comprehension. For both, communication and access to information are critical. This symbiotic connection will be enriched by our intelligent network, which is the essence of our Smart City proposal.

Our Proposal At-A-Glance

Data Gathering Infrastructure
One-time investment

- Data warehouse
  - High-performance computing capacity
  - Distributed hosting infrastructure
- Enhanced fiber network
- Sensors, cameras, and other monitoring devices

Urban Operating System
Long-term benefits

- Data collection and access
- New mobility services
  - AVs, bikeshare, EV carshare
  - On-demand mobility solutions
  - Dynamic parking
- Analysis, optimization, and knowledge sharing

Data allows us to make smarter decisions through knowledge, information and the facilitation of informed choice. And through the use of data, the City of New Orleans, its community and business partners are proposing to transform this 300-year old city into a city where all forms of transportation work seamlessly! Multi-modal mobility by foot, by car, by streetcar, by bus, by ferry, and by bike, connected through technology to manage flow, guide investment and empower individual choice—this is at the core of our vision.

The proposal below is the product of a forward-looking administration with a plan to modernize the city's infrastructure for the innovations of the next century. A suite of new applications will be enabled by these infrastructure upgrades, which ultimately promise to increase the quality of life of citizens throughout the city.

New Orleans Smart City Partners

- Living PlanIT
- Canadian Automated Vehicle Center of Excellence
- Transdev
- Spartan Solutions
- CityWay
- University of New Orleans

Goals, Measurements, and Vision Element Compliance

Our Smart City vision is based on achieving measurable goals that reflect an improving quality of life for our residents.

GOAL ONE

Equitably increase economic opportunity to all residents through smart mobility solutions.

In April 2014, the City of New Orleans embarked on a strategic effort to examine a local report identifying that 52 percent of African American working age men in the city are not working. As a result, the Mayor announced the Economic Opportunity Strategy, which seeks to introduce a new way of connecting all New Orleanians to the city's economic growth through partnerships with local training providers, social service agencies and community advocates. One major barrier for disadvantaged job seekers is transportation.

A key value in our proposal is to ensure that new technologies are distributed equitably across the entire city, including all residential areas as well as areas frequented by our 9 million annual visitors. New Orleans is committed to the USDOT principle of Ladders of Opportunity. Our vision is to provide the tools to empower the poorest residents of the city to access the multitude of jobs that private and public investment are bringing to the city. For example, we propose to create mobility solutions that would allow a disadvantaged resident of the Treme neighborhood to commute every day to a job at the nearby biomedical corridor or the Michoud Assembly Factory in east New Orleans, where NASA is assembling rockets that will one day ferry people to the moon—or to Mars.[1]

A Smart City is one that effectively uses its resources to offer innovative solutions for expanding access to public transportation.

Public transit is currently accessible to 82% of households as measured by residing within a quarter mile of a bus route. Our proposal has been designed to ensure equity via improved access to new mobility services, such as on-demand transit, virtual transit routes, improved healthcare transportation options, a real-time predictive trip planner, and more. Access to mobility is essential to economic development, job creation and improved quality of life.

Measure ▸ Expand new apps and shared ride/on demand transportation options to 90% of households by year three of the project. Ensure continued focus on equity of current public transportation options.

Measure ▸ Implement new modes of services equitably among disadvantaged and non-disadvantaged neighborhoods.

In addition, congestion, wayfinding, parking and movement throughout New Orleans have become more difficult with the community's recent renaissance. A 2015 study by GPS manufacturer Tom Tom ranked New Orleans the 19th-most congested city in the country, finding that the average New Orleanian spends 69 hours per year stuck in traffic.[2] Our proposal includes a real-time predictive trip planner, dynamic parking management and optimization, electric car share and bike share services to help alleviate congestion and improve mobility and parking.

Measure ▸ Launch of new real-time, predictive trip planner by year three. Active carsharing, bikesharing and AV shuttles are operational as described in our proposal within the three-year period.

GOAL TWO

Improve automobile, bicycle and pedestrian safety.

The pedestrian fatality rate exceeds the state and national average and bicyclist injuries have more than doubled in Orleans Parish between 2008 and 2012. In that same period, the average annual pedestrian fatality rate was 2.6 deaths

1 http://www.nola.com/business/index.ssf/2016/01/michoud_orion_spacecraft_nasa.html#incart_m-rpt-2

2 http://www.tomtom.com/en_gb/trafficindex/#/list

per 100,000 residents, compared to the national average of 1.4.

The City has implemented numerous initiatives in recent years in pursuit of a safe, accessible, and pedestrian-friendly transportation network. These include a Complete Streets Policy, installing high-profile crosswalks, right-sizing wide roadways, adding pedestrian countdown signals at high-traffic intersections, securing federal grants to improve safety in school zones, adding photo-enforcement devices in school zones, reducing the number of motor vehicle lanes on select streets, and repairing sidewalks throughout the city. Data from our proposed initiatives will further improve safety through inherent safety advantages of automated vehicles and data-driven policy decisions.

Measure ▸ Reduction in the city's passenger fatality rate to below 2.0 deaths per 100,000 residents by year three of the project.

GOAL THREE

Reduce the impact of climate change through the reduction of carbon-based pollution.

As one of the few cities in the U.S. substantially below sea level, New Orleans has a heightened awareness of the impact of climate change on a community. Since our proposal includes the construction of a major new data-gathering infrastructure for the city, including an extensive network of new sensors across the city's infrastructure and an enhanced fiber network and a new centralized data platform to collect, store, analyze data, we can look at climate change-related data in a new way. This open data platform will help the city and third parties to monitor emissions, traffic congestion, and many other aspects of contribution to carbon-based pollution. We can then use this data to take action towards reduction of this pollution.

Measure ▸ Use rigorous methodologies to measure emissions and other aspects of how New Orleans contributes to carbon-based pollution. Set specific goals for committed reductions in pollution impact in all key categories.

Measure ▸ Increase electric vehicle and automated vehicle mode share and continue pursuing electric streetcar expansion projects.

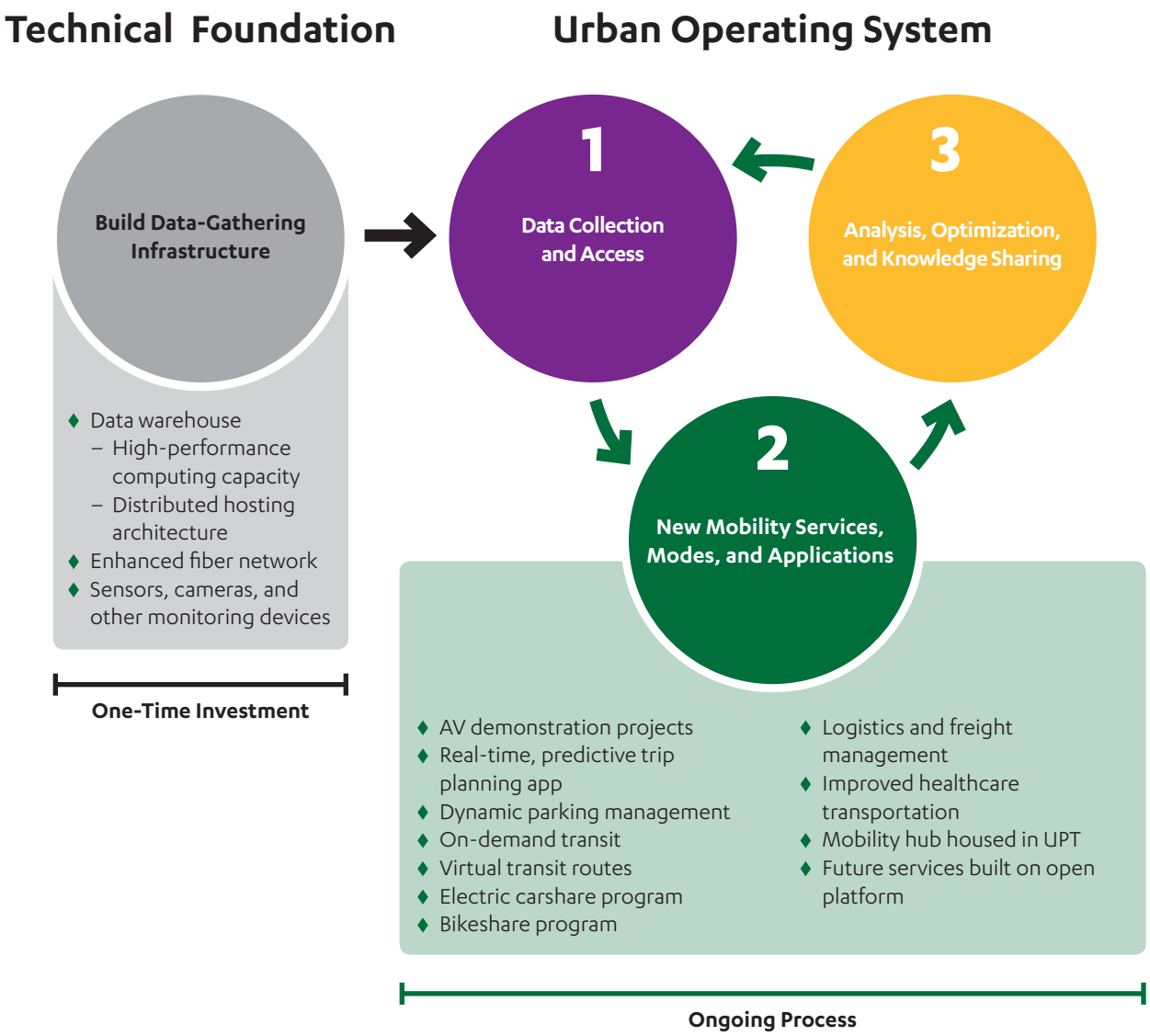
A New Urban Operating System

We are proposing to implement a new Urban Operating System (UOS) for New Orleans – a fully integrated digital data-gathering platform on which solution-based applications and new mobility options can be developed, launched and optimized. We are proposing a multi-partner, multi-modal, accessible system platform which enables real-time optimization of everything from freight shipments at the Port to parking patterns at French Quarter events to new shared ride options. The platform will also allow for continuous evaluation and adjustment of policies.

The UOS unlocks the hidden value of big data generated throughout our city. Our proposal calls for a one-time investment to build a powerful data gathering infrastructure and then explains how the centralized data platform features analytics, security, and open data policies that combine to enable multiple new mobility services, modes and applications.

To make the City's UOS a reality, we have committed to infrastructure investments above and beyond the Smart City $50 million challenge funds. We foresee installing fiber optics network capacity throughout the CBD and major corridors, deploying smart sensors, cameras, and actuators throughout vital Department of Public Works assets, as well as building out data center capacity. Using this data platform, a suite of new mobility options and apps will be launched for both consumer and business users. This system would be designed to be scalable so as to allow it to be expanded into adjacent areas as funds

Our Proposal Elements



allow, eventually growing to a city-wide operating system to maximize the benefits.

The above chart summarizes the elements of our proposed UOS.

The City consulted world-leading smart city experts at Living PlanIT SA to develop a UOS framework that meets the City's needs. The UOS can be deployed throughout the network, at street level through to the cloud. Our current plan is to host the data center at the Regional Planning Commission offices where real-time traffic monitoring already exists. As the system is enhanced, off-site cloud-based redundancies will likely be necessary as well. We will also launch a "Mobility Hub" at the UPT where Smart City project managers will oversee the new suite of new mobility information and options.

We have identified a range of use cases and applications here, but the overall goal is to set the city on a course for innovation that can be informed by the public. By making a one-time investment to build new data gathering

infrastructure, New Orleans can ensure that the foundation for innovation is sufficient for accelerated growth in the Big Easy. In the short term, this network can help facilitate penetration of AVs (powerful sensor hubs in their own right) and enable the creation of a wide range of end-user applications. In the long term, the potential for optimization, and achieving more throughputs with flat capacity, is limitless.

INFRASTRUCTURE ELEMENT

Technical Foundation and Data Gathering Infrastructure

The first step in the UOS implementation process is a one-time purchase and setup of the necessary high-capacity digital data-gathering infrastructure complete with data storage, enhanced computing power, network improvements, and sensors.

Data Warehouse

High-performance computing capacity

The data storage architecture has to be sophisticated and powerful to handle the megadata that will be gathered, processed, and analyzed. Our AV consultants at CAVCOE estimate that each AV will generate 144 Megabytes of data per second: for a fleet of 10,000 vehicles that will be 1.44 Terabytes per second. A lot of this data will be processed locally to provoke interventions that improve flow and reduce disruption. However, to achieve maximum analytic benefit by monitoring trends and anomalies to provide better context for decision-making, much of this data will need to be stored and analyzed by a sophisticated database tool.

One potential partner that has the ability to satisfy the extremely demanding data management, data analytics, and computing resource needs is Silicon Graphics International (SGI). SGI has been providing high-performance computing and storage solutions to scientists and engineers in government organizations, research institutions, and businesses for over 30 years. More recently SGI has deployed their shared-memory products to enterprise business customers as part of the movement towards in-memory databases.

Of particular interest is the UV300, which can be configured with as many as 64 Intel processors and up to 64TB of memory under the control of a single Linux kernel. This shared-memory, multi-processor environment will ensure the fastest possible access to huge blocks of data. Allowing the UOS to run on this best-in-class system will allow us to unlock the full potential of the megadata generated by a Smart New Orleans.

SGI is also committed to extending their unique shared-memory architecture into the future with two following generations of UV products already in development that will be available well into the next decade; further ensuring that the solution developed today will be relevant and scalable into the future.

Distributed hosting architecture

A highly useful adjunct to the network and sensor/equipment infrastructure is a local hosting layer. With the appropriate software solutions, this will provide edge-of-network autonomous control and protocol/data format conversion and allow standardized protocols to be used in higher layers while still supporting a heterogeneous environment beneath. Ideally, hosting hardware is suited for hostile conditions, connection to multiple auxiliary network types and remote operation.

The provision of computing capacity for Smart City platforms and applications is the next consideration. Without analytics, data is simply accumulated information without intelligence or value. With real-time and historical data analytics, the opportunities to extract useful intelligence (and to grow that intelligence over time) are immense. While cloud hosting is often economical and popular, if a large amount of smart city traffic entails local processing and use of locally collected data, then local processing is obviously desirable for quicker access and recall of data. Certain classes of common and highly reusable data, such as video, are best handled locally due to bandwidth considerations. And this type of distributed infrastructure provides strong support for economic redundancy, autonomy, and replication solutions, which are more efficient than cloud or centralized solutions. Finally, provision of regional computing

capacity, whatever the granularity of distribution, can help drive economic activity in the local area and drive in particular the development of social innovation and vibrant Smart City Independent Software Vendor (ISV) ecosystems.

Enhanced Fiber Optics Network

High-speed network infrastructure is a key enabler of an efficient UOS. We envision installing fiber optics network capacity throughout the CBD and major corridors, to enable the deployment of smart sensors, cameras, and actuators placed throughout key Department of Public Works assets.

Sensors, Cameras, and Other Monitoring Devices

The base layer of the UOS consists of a network of connected sensors, devices, and cameras. Crucially, the AVs described in the next section serve as an important source of additional sensors for the network as the AVs will be equipped with a variety of sensors and cameras themselves, and will remain connected to the UOS at all times.

The sensors deployed in New Orleans will include street cameras capable of monitoring parking and congestion situations in real time, microwave traffic sensors on the interstate, and sensors built into the sewerage and water network. Since many of the sensors necessary for a connected city are deployed on privately owned infrastructure, it is almost impossible to build a fully prescriptive sensor architecture for an existing city. However, it is possible to encourage developers, contractors, and solution providers to follow a consistent paradigm as part of following the architecture. This can be simply described as:

- Ensure that no proprietary sensor networks are deployed (or if they are, an interoperability gateway is fitted)
- Ensure that all controlled capital equipment has an openly accessible interface
- Deploy sensors using a shared-model approach on the assumption that sensor capacities will suit all applicable use cases and that results will be made available to multiple systems and stakeholders
- Connect sensors and actuators to IP networks at the soonest practical (and economic) opportunity
- Minimize the diversity of non-IP connectivity (for example useful adjunct connectivity types are 802.15.4 (6LowPan or Zigbee) and RS485 (2-wire serial bus))
- The UOS can already connect to many legacy sensing and actuation systems that exist in a city. In addition, it has the flexibility to be extended easily to other systems in which interfacing information has been declared.

This technical foundation enables the productive functions of the UOS to begin. The system will function as a three-step continuous improvement loop as described below.

UOS ELEMENT ONE

Data Collection and Access

The UOS will feature a software platform that manages the structured organization of stored data (i.e., filing information in the correct place for efficient retrieval) and data access requests (i.e., ensuring that only data is only being seen or used by people authorized to see it).

The software platform is the key to a successful Smart City strategy. A scaled citywide top-level data platform can be built and operated accordingly as a commercial proposition (such as Copenhagen, where Hitachi is deploying the Living PlanIT UOS), but we propose to operate it in the public interest, with limited commercial opportunities leveraged to defray implementation costs. This may help encourage major private developments to use the same platform, leading to maximum effectiveness in data sharing and smart applications for the utility of multiple stakeholders.

Data access and governance

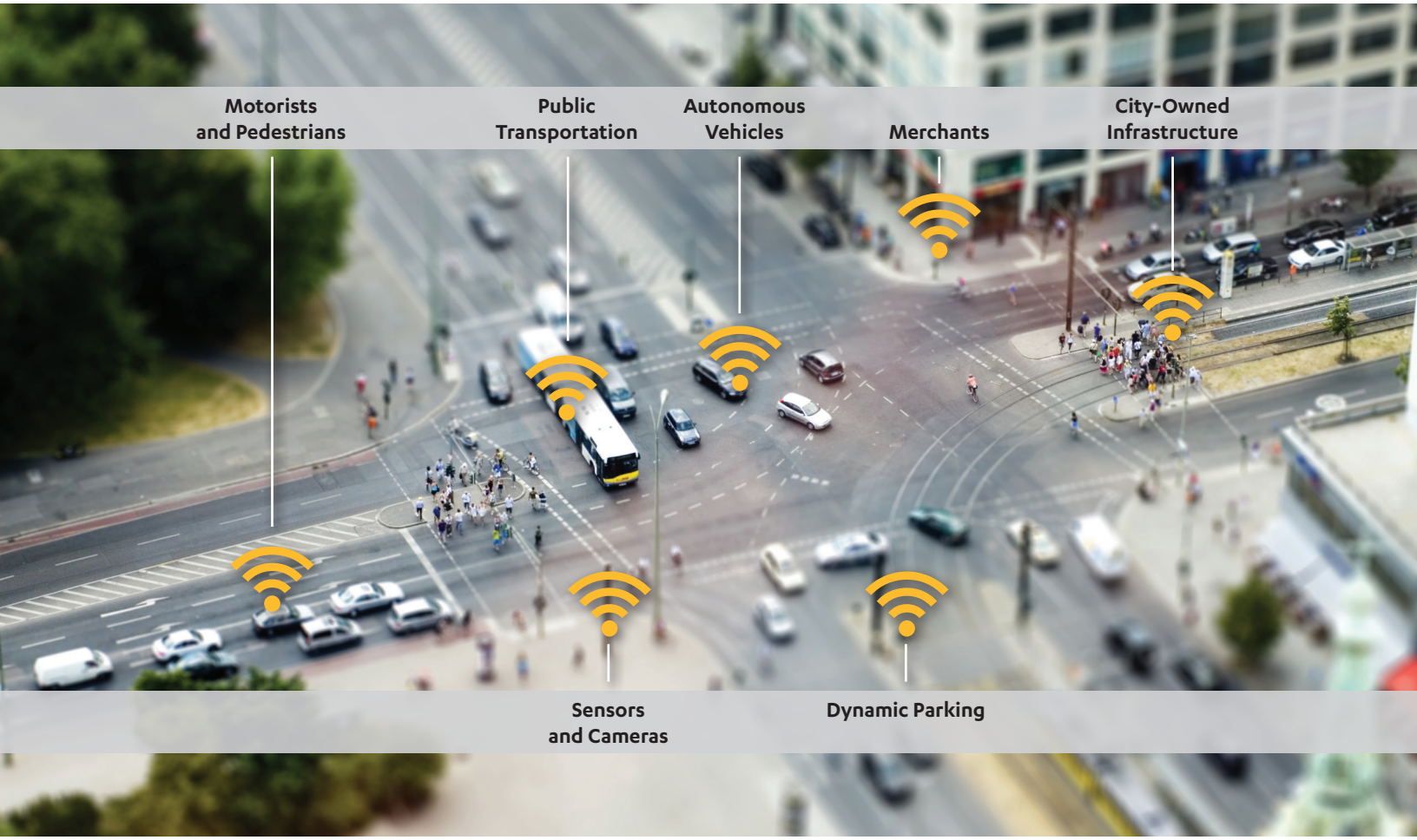
For the full value of the data hosted on the UOS to be unlocked, key parts must be open and

accessible to individuals. However, the sheer scope of the data that will be collected poses thorny new privacy challenges. Our aim is to maintain a commitment both to open data principles and the respect for individuals' right to privacy.

For a successful citywide strategy to be followed, governance—from early planning phases through operation—is critical to ensure that appropriate execution, deployment and appropriate protection of data takes place. We need to ensure that outcomes are optimized to manage what will inevitably be an evolving strategy as the city grows and UOS-related technology develops. This includes managing proper access to data as the City balances its goals of maintaining an open data platform that allows public data to drive private innovation with robust privacy and security measures.

The City will take a proactive approach to owning and maintaining the data generated from the smart city project. Governance starts right at the beginning of the planning process – establishing principles and framework for an integrated approach at the outset is essential to avoid the inevitable siloization and sub-optimization that conventional planning, design, and construction processes will guarantee. This process of establishing best practices between the City, the Regional Planning Commission, and other key stakeholders and partners has already begun.

It is important to note that a Smart City will generate unprecedented amounts of data, including potentially sensitive personal information about citizens. Experts in the field talk of the potential for either "data heaven," where the immense potential value of data-driven decision making is unlocked, or "data hell," where



the sheer volume of information overwhelms intended data privacy and security regulations. There are still many unanswered questions about the way that Smart City big data is owned, stored, accessed, and (potentially) sold. While we do not propose to answer those questions here, we are offering a platform that has data security and privacy protection provisions embedded in its core. Our team includes big data analytics and simulation experts as well as public officials who have adopted their organizations to meet existing open data standards. As we implement our proposal, we will keep data privacy issues at the forefront of our thinking and seek the advice of experts.

UOS ELEMENT TWO

New Mobility Services, Modes, and Applications

The true value of the data collected in the UOS is realized by the new offers and applications built on top of it. A group of new mobility services and transportation modes will be enabled based on data-driven demands discovered by the UOS. These new offers will lead to lower emissions, lower fuel consumption and most importantly, efficient mobility that contributes to greater personal time and quality of life.

Through personal smartphone apps, cloud-based websites, and in-vehicle data portals, we connect users to a variety of program elements through a real-time, predictive trip planning app. This powerful multi-modal app will enable residents to see all their mobility options for getting from Point A to Point B. A resident wanting to travel from Algiers across the Mississippi River to the employment hub at our newly constructed world-class University Medical Center on Canal Street will be able to easily travel using a single trip planner and payment system connecting ferry to bus to a last-mile solution to the doorstep of their new employer. Our dynamic parking and logistics/freight management programs will enable a truck driver delivering oysters to historic Creole restaurant Galatoire's in the French Quarter to navigate the least-crowded path to a waiting loading zone reserved in advance replacing the process of endless circling of the Quarter looking for a chance opportunity to park. The real-time, predictive trip planning app and dynamic parking features will help the Uptown resident wanting to come to the Vieux Carré to enjoy some tunes at Satchmo Summerfest to know in advance where parking is available and its cost to make the informed choice to use public transit instead.

Our proposal also includes new multi-modal initiatives built to connect into our UOS including an AV shuttle route (replacing a planned streetcar expansion line) and preparations for an AV demonstration zone – a 10-block radius in the CBD in which the City funds infrastructure improvements that allow private innovation and AV experimentation to happen. We have also identified shared-ride first- and last-mile solutions that can be used to increase per-vehicle occupancy rates, increase transit penetration in underserved perimeter neighborhoods, and outline a potential use case that unlocks the potential of AVs as dynamically routed commuter shuttles.

Overview of AV Demonstration Projects

New Orleans is convinced that AVs have the potential to transform mobility within the city and will eventually have an impact on almost every other aspect of daily transportation. Our proposal seeks to embrace the early forms of AV technology in their limited state, while paving the way for us to be equipped whenever the fully unmanned capability AV systems are deployed. We are proposing three significant and exciting AV demonstration projects: A fixed-route AV shuttle, an AV demonstration zone, and a shared-ride AV shuttle. We will describe the three projects in detail following an overview of the current context.

AVs do not necessarily have to take the form of vehicles that we see on our roads and streets now. We expect there to be autonomous cars, buses and trucks in the future, but we are also considering the possibility of many other AV platforms that could become a daily part of our lives in

cities by 2025. Once an AV system has been developed that is safe for use by the public, then that system can be fit and calibrated to almost any other type of vehicle platform. Additional AV platforms that are already in development (and that we hope could become a part of this demonstration in the 2017-2020 timeframe) include:

- Lightweight electric pods (could be in-line 2-seater vehicles to suit narrow streets)
- Lightweight pods that combine into 'pod trains' (E.g. Next[3] and the EO Smart Connecting Car[4])
- Self-delivering bicycles
- Sidewalk friendly delivery robots (E.g. Starship[5] and Dispatch[6])

The City's transportation partner, Transdev, has a major corporate objective to explore, develop and operate public transportation services utilizing AVs. This initiative, started in 2015, is giving Transdev invaluable expertise in the procurement and operation of AV-based public transit systems.

Current activities of New Orleans's AV partners in this space include developing the necessary back-office IT system for AV management, a passenger-facing AV app, and trials of automated public transportation products. Transdev currently has 38 trials of automated, electric shuttle buses in various stages of discussion and planning with various partners and stakeholders in North America and Europe. One current project involves Windmill Developments and CAVCOE, who have teamed up to conduct a feasibility and planning study for the demonstration, trial and deployment of fully-automated, electric shuttle-buses at Zibi, a new mixed-use development in Ottawa, Canada.[7]

Transdev has been in discussion with various AV suppliers to evaluate their vehicles, develop business strategies and relationships, and maintain ongoing discussions with government stakeholders and transit partners, which have already provided valuable insight into the requirements and issues faced in deploying AV-based public transportation systems.

At the time of this submission in early 2016, the only commercially available AVs are low-speed electric shuttles from EasyMile and Navya that currently have limited capability on public roads. There are, however, many AVs in development, which are also being actively tracked. There are strong indications that by the end of 2016 several more AV developers will be able and willing to provide vehicles for future AV demonstrations.

We also note the timely announcement by USDOT of President Obama's intention to invest nearly $4 billion in vehicle automation in the next decade.[8] In the same announcement USDOT committed to providing guidance for AV testing and model policies for some time around mid-2016 that will be of benefit to New Orleans, as it develops its AV demonstration proposals. If the budget proposal is successful, then exemption authority will allow NHTSA to enable the deployment of up to 2,500 fully autonomous vehicles. There is, therefore, the real possibility that within the 2017-2020 timeframe of this proposal, that fully autonomous vehicles capable of operating without a driver on board would be able to be used on the public roads of New Orleans.

In addition, there is a clear synergy between the rapidly growing sharing economy and ride-hailing apps, such as between Uber or Lyft and AVs. GM's announcement that they have invested $500 million in the ride-hailing app Lyft included

3 http://www.next-future-mobility.com

4 http://mashable.com/2015/05/08/eo2-flexible-car/#XelNcuGOR8qq

5 http://venturebeat.com/2015/11/12/starship-technologies-delivery-robot-makes-first-public-appearance-at-slush/

6 http://www.fastcoexist.com/3053844/no-more-waiting-for-the-fedex-guy-this-handy-robot-delivers-at-your-leisure

7 http://www.cavcoe.com/Downloads/Zibi_CAVCOE_news_rls_2015-09-01.pdf

8 https://www.transportation.gov/briefing-room/secretary-foxx-unveils-president-obama's-fy17-budget-proposal-nearly-4-billion

a plan to jointly develop an AV network.[9] GM also acquired the select assets of Sidecar and launched its Maven car-sharing program in Jan 2016.[10] Uber, one of the fastest growing companies in the world, is accelerating AV development, as it recognizes that it could be itself disrupted by AV technology.[11] Uber is already offering a transit-like service with its UberHop service in Seattle and Toronto[12] and through emerging partnerships, has started to offer limited transit replacement services in several cities.[13]

As New Orleans progresses to the next stages of the Smart City Challenge, we will look at the opportunities to develop demonstrations that could take advantage of possible USDOT exemptions for AVs and that could source AVs from a wide range of developers: a list that includes major tech companies, automakers, ride-hailing companies, etc. In short, we will provide the AV sandbox and invite private companies to perform tests and demonstrations here.

All AV proposals will seek to take advantage of the benefits offered by AVs, including:

- **Reduced congestion** – AVs can optimize the capacity and availability of roads by balancing the flow of traffic and reducing sudden braking and acceleration that leads to congestion.
- **Safety** – AVs are expected to reduce road crashes by over 80%, which will also reduce congestion on heavily used public roads.
- **Equity** – Wherever possible, the AVs will provide some level of disabled access and will serve areas of all income levels. If fares are being charged, services will be priced equitably. Age restrictions will be relaxed as far as possible so as to serve the youngest generations.
- **Electric propulsion** – Reduces emissions within the city.
- **Controllability** – Fleets of AVs can be controlled so as to give priority to other travellers such as vulnerable road users including pedestrians, bicyclists and other active transportation modes.
- **Reliability** – AVs will perform consistently and won't need unscheduled breaks and won't have 'off-days'.
- **Data-gathering** – AVs will be able to collect and then stream real-time data of everything that is visible in the street scene that, with data analytics, will have immense value to the City, local businesses and the public.
- **Ride-sharing** – With average vehicle occupancy during peak periods in most major cities around 1.2 people per vehicle the aim would be to utilize ride-sharing tools and policies to promote ride-sharing and achieve a minimum of 1.8 people per vehicle for on-demand point-to-point services.

First AV project: Fixed-route AV shuttle

The simplest AV demonstration to stage will be a low-speed fixed-route autonomous electric shuttle service. The most advantageous route for this test would be between the UPT and the Ernest N. Morial Convention Center, the sixth-largest convention facility in the country. The Convention Center supports 23,989 jobs, making it a major employment hub and driver of economic activity for the city. The distance between the two is approximately 0.9 miles.

There is significant trip demand between these locations, especially when major conferences are being hosted at the Convention Center. Intermediate stops would also serve the numerous museums and other tourist attractions in this area. Such a high-profile AV demonstration would therefore provide an additional lure for

9 http://www.bloomberg.com/news/articles/2016-01-04/gm-invests-500-million-in-lyft-to-bolster-alliance-against-uber

10 http://techcrunch.com/2016/01/20/gm-unveils-maven-its-big-play-in-car-sharing-and-other-new-ownership-models/#.0ilhmk:Nc7n

11 http://www.businessinsider.com/uber-ceo-travis-kalanick-on-self-driving-cars-2015-10

12 http://www.theverge.com/2015/12/8/9873544/uber-hop-commute-mass-transit-seattle-chicago

13 http://www.citylab.com/cityfixer/2015/08/uber-and-public-transit-are-trying-to-get-along/400283/

visitors and assist with revenue generation for local businesses and the City.

There are already commercially available AVs that could provide this service, and the City would work with all the other relevant regulatory bodies as well as stakeholders to ensure that all necessary regulations are in place and complied with to help ensure a safe and reliable service.

This concept has already been demonstrated in the real world. Transdev, the City's transportation partner, last year conducted a six-month demonstration in La Rochelle, France, featuring six electric, autonomous minibuses providing transportation between the railway station and the University.

This demonstration would allow the technology to be proved and although not reliant on any additional infrastructure installation, such as fiber or high quality wireless services, would benefit from in-situ sensors and communication infrastructure when it is installed.

Second AV project: AV demonstration zone

A natural progression from the AV shuttle fixed-route phase of the AV demonstration would be to expand transportation services into the CBD and French Quarter with on-demand AV passenger service using a mix of low-speed electric shuttles, such as two- or four-seater pods and autonomous cars and mini-vans. Ride-sharing of AVs would be encouraged to improve efficiency, to reduce energy consumption, and to reduce costs. We envision a true innovation sandbox where new ideas are continuous tested.

For commercial purposes, sidewalk friendly autonomous delivery robots would also be encouraged. These vehicles would typically be the size of a cooler-box and capable of carrying loads of up to 50lbs. These robots could assist small businesses with deliveries to addresses in the AV zone. All transaction details including payment, delivery location and time would be processed electronically.

The purpose of declaring the AV zone is to test new ideas, not for the city to prescribe which technologies should be used. Rather, its purpose is to foster a culture of innovation and attract private companies wishing to research and test their technologies. The city's narrow streets, heavy pedestrian mode share, and strong transit integration present a dynamic opportunity for researchers to confront new challenges in AV testing. By investing in a network of sensors, cameras, and high-bandwidth fiber infrastructure while creating an AV-friendly policy environment, New Orleans residents will benefit from early access to the technologies developed by private companies as they all seek to be first to market with AVs.

Third AV Project: Shared ride AV shuttle
A third phase of the AV demonstration would be to expand services into residential areas of the city to provide improved access from mixed-income housing to the downtown area for jobs, shopping and recreation. This service would be an on-demand and point-to-point service and would benefit greatly during peak period commuting with positive ride-sharing policies. It may also operate best from agreed collection nodes in the residential areas.

Because AVs remove the cost of the driver, it is expected that this type of service would be very affordable. In this case, the low cost of AV operation is compounded by routing overlapping trips in the same vehicle, creating, in essence, a fully automated dynamic shuttle that adjusts its route in real time according to demand. These shared-ride route optimization algorithms are available today; Transdev currently operates on-demand services with them in Washington, D.C. and Helsinki, Finland.

A reliable AV dynamic shuttle service would assist low income worker job retention, and the City would investigate the benefits of providing a partially or fully subsidized AV service in certain neighborhoods. This service could serve to create a supporting structure for job retention, a reduction in welfare-related claims and increased tax contributions.

This service would ideally be provided by AVs capable of travelling on public roads at up to 35 mph. Although there is a low probability of such vehicles being available in 2016/2017, there is an increased likelihood that they will be available later on in the project.

Real-time, Predictive Trip Planning App

One advantage to having transportation data aggregated at the UOS level is that it can be repackaged on demand to meet the requirements of each user. We will be able to offer a real-time, predictive trip planner app that integrates every mode of transportation available to the user and offers automatically generated intermodal itineraries as options. In addition, the app offers a portal to convenient, real-time data aggregated in the UOS as well as payment options.

For example, the optimal route for a young resident from the Uptown neighborhood of Carrollton to her position as an accountant at Caesars Entertainment Corporation at the base of Canal Street could be truly multi-modal: a drive to a park-and-ride, to take the streetcar down St. Charles Avenue, and ride the last quarter-mile on a bikeshare. These options would be presented to the user, along with other options.

Multimodal trip planning apps are common around the world (a version of the feature is even baked into Google Maps). However, most are actually quite limited in their depth and scope. Our transportation partners have taken trip planning to a new level following the successful roll out of a sophisticated multimodal trip planner in operation in Lyon, France and Toronto, Canada. We envision a mobility solution that takes the principles of multimodal trip planning and amplifies them using the UOS, with predictive traffic management algorithms that anticipate congestion and route users away from clogged roads, as well as events and roadwork integration. Knowledge of delivery schedules, planned disruptions, weather patterns, and all the other data in the UOS will make the outputs generated by the trip planner that much more powerful and relevant.

Part of our vision is that this real-time, predictive trip-planning app becomes a true mobility portal. Over time, it will incorporate all of our new apps and new modes. We see it as the consumer's "go to" app for all forms of public transportation, ride sharing, on-demand transit, virtual transit routes, dynamic parking, bike and car sharing, and healthcare transportation (ADA, Medicaid, HMO, etc). It is currently functioning this way in Lyon (integrating all available forms of mobility including on-demand shared ride) and how it will function in Toronto when the next phase of development is complete. As citizens use the mobility app, they provide information to the city about trip demand. This helps inform future transit-planning decisions and creates opportunities for new services.

It is important to note that this mobility app does not need to be strictly focused on transportation. There are vast opportunities for partnerships with private businesses. For instance, a person planning a route ending near a coffee shop could be offered a discount on coffee by the shop owners upon arrival, generating a more personally tailored experience for the user and building economic value.

Dynamic Parking Management

Dynamic parking management is another key element of New Orleans Smart City proposal. Harmonizing the balance of private vehicles with shared ride options or alternative transportation modes is key to successfully impacting mobility.

Issues of congestion, air quality, street capacity, noise pollution and urban life quality all involve how we move vehicles through our city. The problem is potentially addressed in two ways. First, reduce the number of vehicles on the street network. This is addressed through shared ride service offers such as public transport, bike sharing and car sharing. Second, move vehicles in and around the city more efficiently. This is where parking management becomes such an important element to the mobility equation.

The average city driver spends six to fourteen minutes searching for parking. In New Orleans the problem is exacerbated even more with a historic French Quarter built before the invention of the automobile, a random influx of traffic caused by festivals and conventions, and a vibrant commercial district with the constant delivery of merchandise. Compounding the problem are the district's narrow streets that make capacity increases difficult to impossible. In fact, while increasing parking capacity may reduce unproductive road travel resulting in increased road network capacity, such gains are short lived as the number of vehicles parking downtown increase and congestion returns.

The City of New Orleans has attempted a policy approach as well, instituting a parking meter fee hike to $3 per hour, which has had a limited effect on the problem. The real solution lies in understanding the habits of those seeking to find parking. This requires data, not gut instinct, to determine the efficacy of new policies. It also requires a real-time understanding of parking supply and demand in order to manage this environment in real-time to achieve the desired result.

Streetline, an industry leader in parking management, speaks to a Smart Parking Ecosystem designed to connect merchants, motorists and technology. By using a variety of sensing technologies including

smartphones, video feeds, parking space sensors and more, real-time data can be gathered and communicated to potential users. The collection of this data 24/7, 365 days a year also allows the measuring of demand variables. This is an critically important point in the context of New Orleans, where over 80 festivals a year, a vibrant cruise port, and a large influx of convention business can upset the "norm" of a typical day. This makes New Orleans a perfect test environment for measuring the impact-parking management can have on the total mobility of the city.

Parking space availability data can be distributed to citizens through the real-time predictive trip-planning app as well as with aggregated real-time data through live information displays that go straight to the dashboard of a connected vehicle (through Apple's proprietary car interface, for example) or in other creative ways developed by the private sector—a benefit of the City's Open Data approach. Thus, the intermodal itineraries provided by the user app will specify not only the route to take, but also the precise location of the available parking space that the user has been allocated. This prevents the aimless circling and wandering pattern exhibited by drivers searching for parking spaces, a major driver of congestion. Drivers will no longer circle the block looking for a parking space that does not exist—they will travel straight to the nearest available one.

As historical data about parking demand and supply is collated, the City can make more informed decisions about parking prices. For example, during a special event that will cause a surge in parking demand, the City could decrease parking prices in a nearby area and increase transit capacity between the parking area and the event location. Dynamic pricing can also be used to encourage alternative modes of travel. For example, imagine a system that wants to reduce congestion by raising parking fees while simultaneously reducing ferry and transit fares. The consumer choice is not only based on availability but also on economics: a powerful combination.

In the short term, we propose to deploy parking monitoring cameras that will enable these dynamic parking systems throughout the French Quarter and Warehouse District.

On-Demand Transit

The arrival of smartphone ride-hailing apps Uber and Lyft is beginning to generate a global shift from capacity-driven to demand-driven mobility solutions. Even as we optimize the City's fixed-route transit network using data, on-demand applications will soon begin to seriously compete with transit as they cut costs and decrease average arrival times. To compete in the newly competitive mobility marketplace, we believe that the City's public transit network must implement a radical new offering: a dynamically routed bus or mini-bus that responds to trip requests in real time.

To be clear, private ride-hailing apps are an important component of personal mobility and fit in to the city's long-term transportation plans. However, we feel it is paramount for subsidized public transit to remain a viable option for the city's most vulnerable residents.

Imagine a world in which passengers access public transit the way they hail an Uber today: indicate your pick-up and drop-off locations on your smartphone, and let the system route you onto a bus (or mini-bus depending on volume) full of people going in the same direction. Using big data and predictive algorithms from the UOS, supply is optimized for anticipated demand and adjusted seamlessly on the fly. Equipment is deployed to match demand, so resources are always balanced with supply.

We intend to implement an experimental version of this feature to increase transit penetration in the city's underserved neighborhoods. Besides the benefit of convenience and delivering service to underserved areas, dynamically routed first/last mile solutions have the effect of driving down per-passenger trip cost and increasing passenger vehicle capacity. Transdev already possesses dynamic routing capability and is in the process of conducting trials.

Virtual Transit Routes

One benefit of the UOS is that over time it creates a picture of traffic flows in the city, and of people's

overall traveling patterns. There is inevitably a high degree of overlap in single-occupancy private vehicles traveling from the suburbs on interstates, such as Interstate 10, to downtown. We want to encourage people to carpool using a virtual carpool feature built directly into the trip planning application and available as a standalone app.

One example of such an opportunity is a prototype system being developed by Transdev's subsidiary Cityway that enables private car owners to make their morning commute via a virtual bus route. The driver simply indicates the path he takes to work every morning and the time and number of seats available. For the cost of a bus fare, other riders are able to book a seat in his vehicle and share the ride. The driver is reimbursed a majority of the cost of the bus fare to help cover fuel costs. The resulting effect provides increasing mobility options for underserved residents and increasing the number of occupants per vehicle. Trip demand data generated by users of the mobility app will help inform the way this program is rolled out and optimized.

The end result is an unlimited number of "virtual fixed routes" that augment the existing transit network and increase passenger vehicle occupancy.

Electric Carshare Program

Carshare programs have already demonstrated their effectiveness in reducing private-car ownership. Two out of five Corporate Zipcar members indicated that they sold a vehicle or postponed a vehicle purchase due to joining Zipcar.[14] Our goal is to create a system that reduces vehicle ownership and carbon emissions. The best way to do this is to offer a carshare system that only features electric vehicles.

This is not an unprecedented idea. Paris and London already feature electric carsharing networks, and Blue Indy, in Indianapolis, has rolled out 50 of its planned 500 electric vehicles in the city, to go with a network of 125 charger-equipped parking spaces.

Carshare companies continue to express interest in the New Orleans market, but the lack of a system allows us to build a fully electric system from the ground up. The Paris and London systems have both dealt with growing pains, including issues about who maintains the charging stations and vandalism problems. New Orleans will be able to build a system that has already learned from these mistakes.

Because of the high capital start-up costs, it is unlikely that the City would implement the EV carshare system directly without assistance from a company like Vulcan, Inc. Therefore, a private company with expertise in the field would be selected to operate it with close supervision and integration to the UOS.

Such a program will be of considerable value to the AV demonstration program as it expands as it is very likely that most, if not all, of the AVs used will themselves be battery electric vehicles (BEVs).

Bikeshare Program

New Orleans currently lacks a bikeshare program such as Citibike in New York. We plan to implement such a program as part of our Smart City proposal.

Summary

This graphic summarizes our suite of proposed mobility services, shared ride options and apps that build upon the data infrastructure to greatly improve mobility in the city.

- AV Demonstration Projects
  - Fixed-route AV Shuttle
  - AV demonstration zone
  - Shared ride AV shuttle
- Real-time, Predictive Trip Planning App
- Dynamic Parking Management
- On-Demand Transit
- Virtual Transit Routes
- Electric Carshare Program
- Bikeshare Program
- Logistics and Freight Management
- Improved Healthcare Transportation
- A Mobility Hub Housed in UPT
- Future Services Built on Open Platform

14 http://innovativemobility.org/wp-content/uploads/2015/07/Zipcar_Corporate_Final_v6.pdf

With 25-45% of bikeshare trips replacing vehicle trips nationwide,[15] a well planned bikeshare system that integrates with transit can both displace vehicle trips and increase transit usage while providing a healthy first or last mile transit option.

The conditions are ripe for bikesharing to have a big impact in New Orleans. The city already possesses over 100 miles of bikeway, with 60% of the city's 72 neighborhoods served by at least one. Our 2.1% bicycle modeshare is twice as high as any other Southern U.S. city, but still far too low.

The City has already internally produced a feasibility study on bikesharing programs evaluating the best options for New Orleans. The City's bikeshare feasibility study found that the city's dense street network lends itself to bicycle traffic by keeping maximum automobile speeds low with frequent stops. In short, New Orleans is ready to support a successful and sustainable bikeshare system.

While stop locations have not been finalized throughout the city, a key first station will be placed at UPT to maximize the station's multimodality.

We must take special care to ensure that the equity and workforce development results of bikeshare implementation are maximized. While some bikeshare programs, such as Washington, D.C.'s Capital Bikeshare and London's Santander Cycles, have succeeded in capturing commuter modeshare with over 2/5ths of system trips being work-related, over 65% of trips on Brisbane's City Cycle program were found to be for leisure or sightseeing. The racial makeup of bikeshare users in Washington, D.C. and London hints at inequity as well. In Washington, only 3% of capital bikeshare users are black, in a city of 49.5% black population. In London, 88% of bikeshare riders are white compared with 55% of the overall population.

Ensuring that New Orleans's bikeshare system serves the entire community will require forward thinking and a higher initial investment to provide service in all neighborhoods, but will be necessary in the long run to meet a standard of equity through this critical component of affordable transportation. The City's bikeshare feasibility study initially identified nine neighborhoods not recommend for bike share deployment in phase one. While it would be more expensive to expand the system to include all nine of these areas, we will ensure that they be carefully considered before implementation so that the benefits of the system are distributed throughout the entire city. Thoughtful integration with the transit system and a cash payments system are two ways to increase the system's utility to poor or underbanked residents.

While it is possible that a private company could operate the City's bikeshare system, the feasibility study recommended an administrative non-profit organization that would manage the system in its entirety for the public good.

As noted in the AV section, automated systems can be applied to any platform and we are aware that self-delivering bicycles are already in development by China's Baidu.[16] The Elcano Project, out of the University of Washington, is also developing a self-driving tricycle. [17]

One of the biggest challenges for the efficient operation of bikeshare programs is daily commuter flows resulting in bikes being left in clusters that are not coincident with demand. This results in constant manual relocation of bikes to sync with demand, which costs the operator time and money. However, a self-driving, self-delivering AV bicycle could dramatically improve the bikeshare paradigm as it could be summoned by a user on their smart device, paid for electronically and left anywhere within a defined zone of operations primed for relocation as needed.

In addition, within an AV zone (as described above) bicyclists will feel safer as the AVs will be extremely courteous and patient drivers. This process will dramatically lower the barrier to entry for many would-be users that are cautious of trying bikeshare.

Such improvements around both rider safety and convenience are expected to have a positive influence on bikeshare ridership and potentially

15 2013 Unpublished city bikeshare feasibility study

16 http://nextbigfuture.com/2014/08/elcano-self-driving-trike-for-under.html

17http://nextbigfuture.com/2014/08/elcano-self-driving-trike-for-under.html

to be transformative for active transportation. Increased ridership also creates a virtuous circle as regular bike riders have, on average, improved health, have longer working careers and place a lower burden on health services.

New Orleans and its partners will actively monitor developments of self-delivering and self-driving bike technologies and incorporate them into the bikeshare program if possible.

Logistics and Freight Management

The same principles that apply to the parking management application also apply to logistics and freight delivery management, particularly with regard to the Port of New Orleans. The port moves 31 million tons of freight and over a million passengers per year, but faces numerous operational challenges that reduce efficiency. Just last week, an 18-wheeler trying to pass through the French Quarter caused a massive disruption when it became stuck under a low hanging balcony while trying to turn from Barracks Street to Burgundy Street.[18]

A lack of information and synchronization often contributes to a logjam of different modes intersecting at the banks of the Mississippi. After being stuck in traffic on Interstate 10, truckers seeking to pick up freight from the port often encounter frustrating delays while nearing the port on surface streets. Trucks tend to arrive at the same times (early morning and late afternoon), creating a bottleneck of trucks at the entrance to the port campus. To make matters worse, railway lines pass directly in front of the port's entrance—whenever the train is passing, all trucks are blocked from entering and exiting.

The Port Authority is in the process of testing a Software-as-a-Service (SaaS) solution for freight truck Automatic Vehicle Location. Even in isolation, the benefits of such a system are obvious: synchronization of scheduled truckload pickup times with shipment arrivals from the port, traffic management as trucks seek to leave the port simultaneously, and historical data on traffic trends.

Moreover, when linked up to the rest of the UOS, this AVL data becomes truly powerful. With real-time congestion and roadway accident information, trucks can be diverted into clearer roads to ensure on-time arrival if needed. UOS integration would also allow for some outbound freight shipments to be possibly redirected on to the canal railroad and delivered to the port by rail, eliminating the need to traverse congested surface streets entirely. The system enables multimodal freight just as it encourages multimodal personal mobility.

At a local level, the software that would power the dynamic parking system could alleviate tremendous amounts of delivery-related congestion in the French Quarter. Currently, the district's numerous bars, shops, and restaurants require frequent shipments of perishable goods and other items from delivery trucks, which often block the narrow streets and restrict traffic. With a bird's eye view of the current parking situation, the City could pre-assign certain spaces and times for business delivery needs, optimizing traffic flow and eliminating a great deal of congestion.

Another promising delivery and logistics initiative of sidewalk-based automated delivery robots are enabled through the City's proposed AV demonstration zone**.**

Improved Healthcare Transportation

Medicare and hospital data show that demand for outpatient services at hospitals is increasing nationwide.[19] Connecting New Orleanians to the University Medical Center, a state-of-the-art, $1.1 billion facility completed last August, is an important objective of our proposal.[20] The UOS will enable new efficiencies in transportation unlocked through reduced per-passenger trip costs, higher per-vehicle occupancy, and increased availability of wheelchair-accessible AVs to those who need them. Further, the big data generated by the UOS promises to help

18 http://www.wwltv.com/story/news/2016/01/27/18-wheeler-stuck-french-quarter/79413188/?c=n

19 http://www.hhnmag.com/articles/5005-the-great-migration

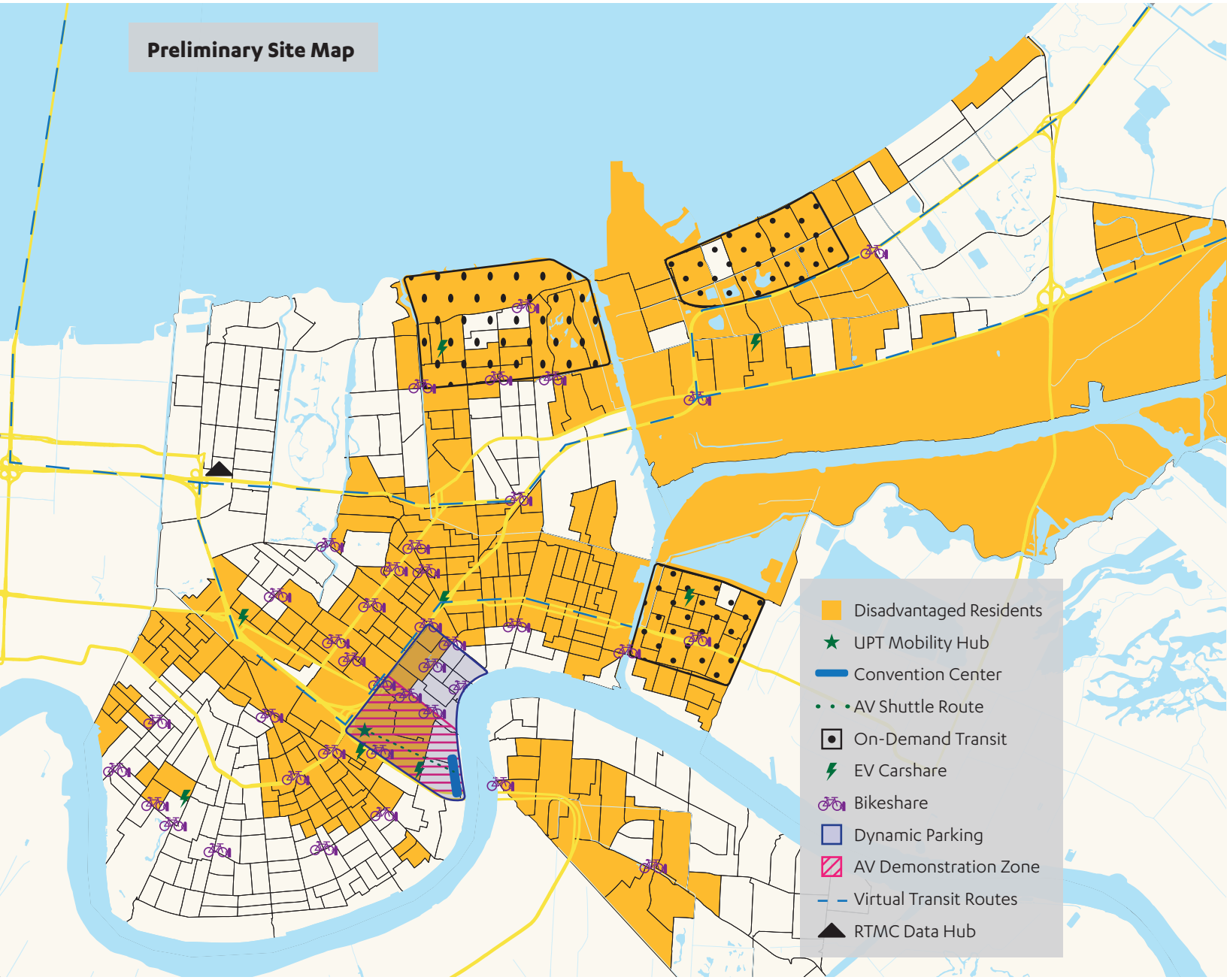
20 http://www.nola.com/health/index.ssf/2015/06/look_inside_the_new_1_billion.html

optimize paratransit operations, driving down costs and improving service. The bikeshare program offers another means of accessing health care for some consumers.

A Mobility Hub Housed in UPT

While the data processing backend of the project will be housed at the Regional Planning Commission, the physical symbol of New Orleans's new mobility area will be the historic Union Passenger Terminal in the CBD. A major rail and intercity bus hub served by streetcar and bus transit lines, UPT is an important portal for people entering and exiting the city. Its importance will only be strengthened when the proposed commuter rail linking Baton Rouge, New Orleans and the seven parishes along the Mississippi River alignment is installed.

The City sees UPT as a symbol of the new multi-modal New Orleans and the hub of two



new proposed programs, a bikeshare system and an Electric Vehicle-only carsharing program. The City owns not only the UPT property but the land under the nearby, elevated Pontchartrain Expressway as well, allowing the City to make quick and expedient decisions on the rollout of these programs. From this Mobility Hub, operations teams would ensure that all the planned mobility services and apps are functioning well and delivering promised services to customers with high standards of quality.

Future Services Built on Open Platform

The horizontal, open architecture of the UOS enables development of new applications and use cases. When proper access and anonymization protocols are implemented, the capacity for individuals and independent software vendors (ISVs) to create new innovations on top of the UOS Smart City framework is unlimited.

A key space in which the UOS will enable powerful innovations is in energy management. A building enabled with intelligent sensor infrastructure and connected to the UOS could improve energy efficiency by avoiding unnecessary lighting and heating/cooling of common and unoccupied areas, and better understanding of energy losses (parasitic losses in appliances not in use, unnecessary lighting / HVAC, inappropriate device settings, etc.) enabled by sensors, data collection, and analytics. A "smart building" enabled with appropriate sensors can be optimized over time to efficiently suit the needs of its occupants.

The optimal application strategy is to enable an open market for applications running on the software data, control, and application-enabling platform described above, while providing a safe and secure way of doing this by exposing data via application processing interfaces (APIs). This addresses various needs from multiple stakeholders and isolates by specific vertical solution areas. The majority of these applications run on mobile devices. However, some more specialized solutions run on dedicated hardware, TVs, touchscreens, web browsers, and control rooms. A local ISV ecosystem can be grown to support these applications, but existing ecosystems, which support Smart City platforms, can also be leveraged with applications imported from similar city developments—a core value proposition for coherent software platforms is portability of applications.

UOS ELEMENT THREE

Analysis, Optimization and Knowledge Sharing

While the applications and services above are at least in part enabled by the data hosted in the UOS, they also generate data themselves. The time and location of every trip-planning app information request through the app will be recorded—over time giving a picture of how and when mobility decisions are being made. Observed patterns and trend analysis in bikeshare utilization can lead to a fuller picture of commuter patterns. Peak parking demand times can provide insight to help combat congestion. As more new services are implemented, more data is generated—and all of it is fed back into the UOS.

The data generated through these new services can be analyzed to discern trends, develop future management strategies and develop informed public policy. From our proposed Smart City Hub located at the UPT, our Smart City team will have access to the data measuring the pulse of the city for analysis. It will be used to develop new transit options, realign transit services and service levels according to demand, become the basis of new pricing policies for both publicly accessible transit and privately used parking, provide the rationale for supporting physical roadway infrastructure improvements including signalization and streets, as well as measuring the effectiveness of current policies and practices. This project is about analyzing and understanding data so that we can take action.

The data generated by UOS-enabled products can be analyzed to help continuously improve products themselves, creating a positive feedback loop through which the city's disparate processes continue to develop and mature with time.

Data Analysis and Simulations

An important benefit of the UOS is the ability to analyze the terabytes of data that are generated by the network of sensors across the urban landscape. Our partner, Living PlanIT, has expertise in the field of big data analysis and simulation.

For example, using a process called Building Information Modeling (BIM), the team analyzed real-time sensor data in London City Airport showing detailed passenger movements throughout the terminal. By observing pedestrian walking patterns and simulating how pedestrian flows would be affected by environment changes (i.e. turning a bookstore into a coffee shop), the team was able to ideate a new configuration for the terminal that increased efficiency, productivity, and passenger satisfaction.

It is not hard to imagine the applicability of that technology here. The exact same BIM process should inform the redevelopment efforts at UPT. Other pedestrian-heavy areas in the city should be subject to the same sort of analysis as well. It is easy to apply the same simulation principles to transportation and infrastructure decisions. Building a virtual model of passenger flows within a bus route would help make transit service decisions easier, or help determine where on the sidewalk a bikeshare station should be placed.

Smart Cities are, in principle, cities with the tools to constantly re-evaluate and re-optimize themselves. Plugging a simulation model into the UOS enables those evaluations to happen constantly on a highly sophisticated level.

Knowledge Sharing

While New Orleans is unique in character it is not unique in its challenges. A Smart City of New Orleans will have lessons learned, successes to share and failures to avoid. The Merritt C. Becker, Jr. University of New Orleans Transportation Institute (UNOTI), a designated University Transportation Center by USDOT, along with other national institutions, will observe, analyze and write about our Smart City experience to share with other city leaders and planners. This effort is not a "one off" but rather a movement and as such must be documented and shared with cities across the country.

Research Partnerships

We recognize that the developments outlined here when taken together represent an unprecedented leap toward the Smart City vision. The fact of the matter is that no one knows what the city will look like once all of these elements have been implemented. For that reason we have enlisted Jim Amdal, a Senior Fellow of the Transportation Institute at the University of New Orleans to assist with analyzing the short and long-term impact of these initiatives as they are implemented. It is important that others are able to learn from the transformational process we put ourselves through.

Proposal team member Living PlanIT has existing professional relationships with Harvard University and the Massachusetts Institute of Technology to analyze and perform research on their Smart City demonstration projects across the world. To the extent that Living PlanIT continues to be involved in our proposal, Harvard and MIT researchers will be involved as well.

Intelligent Transportation System (ITS) Architecture

The Regional Transportation Management Center (RTMC), where the Regional

Planning Commission is located, is a state-of-the-art facility, which utilizes Intelligent Transportation Systems (ITS) applications to design and aid in regional coordination such as facilitation of communication among drivers, traffic operations staff, emergency response personnel and other agencies to maximize the use of existing roadway throughout the region. At this facility, traffic management staff monitor traffic conditions throughout the region in real-time through the use of various ITS tools, such as traffic cameras and vehicle detectors. Roadway conditions are communicated with drivers and emergency responders through use of Dynamic Messaging Signs, Twitter, and the 511 Traveler Information System. The technologies employed at the RTMC assist with the congestion reduction, aid in the prevention of accidents, and shorten the response time for emergency personnel to respond to the accidents. This resource will be an essential component in fulfilling our vision for thorough sourcing and innovative application of transportation data.

Of the eight core Service Packages in the ITS Architecture, our team's objective is to utilize them all. Five will have a major role in the system design and implementation, and the other three will also be involved but to a lesser extent.

ITS Architecture Service Packages

Major Role	Minor Role
♦ Advanced data management	♦ Commercial vehicle operations
♦ Public transportation	♦ Emergency management
♦ Traveler Information	♦ Maintenance and construction management
♦ Vehicle safety	
♦ Traffic management	

Both the State of Louisiana and the City of New Orleans have developed regional and local ITS architectures, which are consistent and useful. In addition, New Orleans' Regional Transit Authority (RTA) operates fleets that include buses, streetcars, paratransit services, and ferries. These are primarily part of the Public Transportation and Traveler Information service packages although the Advanced Data Management and Vehicle Safety service packages are also involved.

Due to the efforts of USDOT in accelerating the introduction of connected vehicle (CV) technology, many established Advanced Traffic Management Systems (ATMS) vendors have upgraded their ATMS to incorporate CV functionality. The New Orleans RTMC is home for the ATMS in this project and will play a critical role for any future AV and CV initiatives.

In addition, the team fully understands the synergies between AVs, CVs and EVs and the convergence of these three technologies into ACE vehicles (automated, connected and electric). Hence, the Connected Vehicle Reference Implementation Architecture (CVRIA) will be very relevant and useful to the proposed Smart City Challenge deployment, as will the standards related to EVs.

The New Orleans team commits to using the CVRIA, the National ITS Architecture and relevant standards in its detailed description and specification of the systems involved in the proposed deployment. The team fully understands the importance of utilizing the architecture and standards and of documenting any issues that require attention.

Background and Context

Demographic Profile of New Orleans: A Mid-Sized City

With a Census-designated place population of 343,829 according to the 2010 census, New Orleans falls squarely into the mid-sized city tier defined by the USDOT's Notice of Funding Opportunity. With a Census Bureau-defined land area of 169.42 square miles, New Orleans's population density is 2,029.4 people per square mile. The New Orleans –Metairie – Hammond Combined Statistical Area had a total population of 1,413,882 in the 2010 census, with the 343,829 residents of New Orleans comprising 24.32% of the total MSA population.

Characteristics that Align New Orleans to Smart City Challenge

Unprecedented investment in road infrastructure

Today, there is more roadwork now any time in recent history. After taking office in May 2010, Mayor Landrieu hit the reset button on the City's negotiations with the federal government on Hurricane Katrina-related damage. Since then, the City has met with FEMA over 825 times producing $946.7 million more in new funding to rebuild and repair public facilities and streets. So far, the City has completed 247 road projects totaling $342 million and resulting in 111 miles of new roads. Right now, there is over $150 million of road construction either in design or under construction across New Orleans. This infrastructure work includes FEMA-funded Recovery Roads, Community Development Block Grant funding and City bond funded projects. In 2015, the City completed over 40 road projects valued at $80 million, representing over four-times the amount of infrastructure work performed by the City annually, on average, prior to Hurricane Katrina.

A robust existing public transportation system

In service to the Regional Transit Authority, the City's private-sector transportation partner, Transdev Services, Inc. operates a well established, highly used transit system, including a fleet of 138 buses, 64 paratransit vehicles, and 66 streetcars providing over 19 million trips per year. The St. Charles streetcar line is the oldest continuously operating streetcar in the world. In fact, New Orleans has the most extensive streetcar system in the entire U.S., which is widely used by locals and visitors (See Table 1). A major expansion of the streetcar system is currently underway, to be opened later in 2016. Notably, the streetcar system connects to over 90% of the bus network, making the city a terrific example of intermodal connectivity in the U.S. Transdev also operates the New Orleans Ferry service across the Mississippi River.

In 2015, RTA buses and streetcars ran 5.24 million revenue miles over a route system serving 75 square miles. The RTA has approximately 2,300 bus and streetcar stops and 300 passenger shelters. Since 2009, transit ridership has increased seven percent annually due to a thoughtful restructuring of routes to specifically connect transit-dependent populations to major employment centers in the Central Business District (CBD), Mid City, and the French Quarter. The RTA is currently in the process of improving and modernizing vehicle-location (GPS) data collection by procuring a new CAD / AVL system.

Table 1
Proportion of RTA Passengers by Origin

	Resident	Visitor	Total
Bus	97%	3%	100%
Streetcar	76%	24%	100%
Total	93%	7%	100%
Streetcar Lines			
Riverfront	17%	83%	100%
Canal Streetcar	90%	10%	100%
St. Charles Streetcar	74%	26%	100%
Total	76%	24%	100%

Source: Regional Planning Commission, COA, 2013

Paratransit Service – RTA's paratransit service provided service to almost 1,200 active registrants, using both RTA owned lift equipped vehicles and contractor owned and operated accessible minivans in FY2011.

Ferry Service – Transdev operates pedestrian ferry service between Algiers Point and downtown New Orleans as well as Algiers and Lower Chalmette, which allows for connections into the RTA system for added mobility.

Other Transit Operators – As a regional transit authority, the RTA also operates local bus service

in the City of Kenner in Jefferson Parish and is anticipated to start airport express service in Spring 2016 between the City of New Orleans and the New Orleans International Airport.

Further, the RTA system connects to two other fixed route public transit operators. St. Bernard Transit (SBURT) and Jefferson (Parish) Transit (JET) in downtown New Orleans, Wilty Terminal in Gretna and at other transfer points. JET operates eight bus routes that connect with RTA services.

Other mobility options

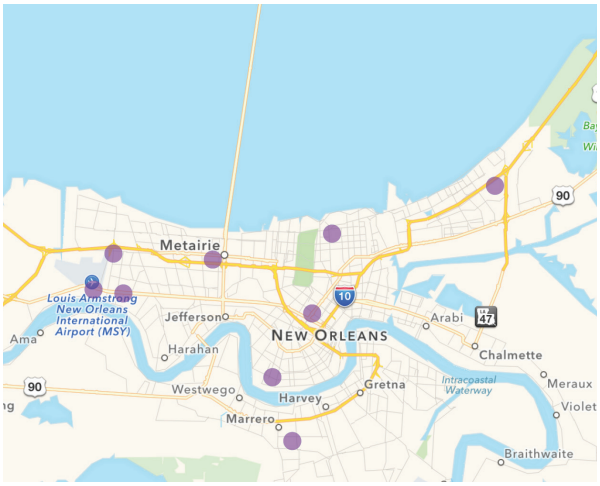
The number of people bicycling and walking in New Orleans is up. New Orleans was recently ranked a "silver" bicycle friendly city and 5th highest of major US cities in the percentage of commuters bicycling to work. New Orleans was also ranked a "bronze" Walk Friendly Community. Over 100 miles of bikeways now reach more than half of the city's 76 neighborhoods, including the Lafitte Greenway, a 2.6-mile bicycle and pedestrian trail and green corridor. Safety for all road users—drivers, bicyclists and pedestrians—remains the top priority for the Mayor.

Conducive environment for proposed strategies

Over the past decade, the City of New Orleans has focused on delivering innovative strategies to revitalize its public transportation network. These range from adding new transportation capacity, such as two new streetcar lines and the transformation of historic Union Passenger Terminal (UPT) into a multi-modal transportation hub to strengthen economic opportunity and revitalize a downtown corridor, to our launch of electronic trip planning for transit riders. We have an ambitious plan for future expansion of all mobility options, including walking, biking, bus, streetcar, paratransit, and possibly BRT services, and continued digital services for passengers, such as our new RTA mobile ticketing service "GoMobile" which allows purchase of transit tickets from a smartphone.

In August 2015, Mayor Landrieu revealed the world's first Resilience Strategy. Guided by 100 Resilient Cities - Pioneered by The Rockefeller Foundation, Resilient New Orleans combines local expertise with global best practices to confront our most urgent threats and seek ways to redress our legacy of inequity and risk. One section of our approach is transform city systems where we propose to redesigning our regional transit systems to connect people, employment and essential services.

The City of New Orleans has prioritized a comprehensive strategy to connect disadvantaged job seekers and business to new opportunities. This strategy includes collaboration with some of the region's largest employers and job centers. The City also continues to foster entrepreneurship by creating partnerships with the private sector and non-profit organizations, such as the NOLA Business Alliance and the Idea Village, a vibrant 501(c)(3) with a track record of identifying and retaining entrepreneurial talent in New Orleans. The Brookings Institution has reported that startup business creation in the City of New Orleans has exceeded the national average by 56% from 2009-2012, and by 33% over fast-growing Southern cities like Houston and Atlanta.[21]



Existing EV charging infrastructure

The New Orleans metro area features nine public EV charging stations indicated on the map above.

Existing transportation infrastructure

The following is a breakdown of road networks in Orleans Parish.

- Freeway (includes exits/ramps): 127.96 miles

21 http://www.entrepreneur.com/article/232360

- Principal Arterial: 97.38 miles
- Minor Arterial: 287.75 miles
- Major Collector: 189.42 miles
- Minor Collector: 41.48 miles
- Local: 1,165.18 miles

This network of roads collectively allows for accessible urban neighborhoods in our city and affords us an opportunity to further optimize their utilization and levels of service through data-enhanced management.

Continuity of committed leadership

The City of New Orleans benefits from seasoned leaders with deep experience in the planning and execution of ambitious initiatives, skilled in the coordination of committed parties with varied interests. Mayor Landrieu remains committed to creating opportunity for all New Orleans residents.

Our Metropolitan Planning Organization benefits from the energy and expertise of dedicated commissioners and from Executive Director Walter Brooks, who is responsible for creatively managing a constrained budget and balancing the repair of our street and traffic signal systems with innovations for our roadway system.

Furthermore, Transdev's Public-Private Operating Partnership (PPOP) contract with the RTA was recently renewed for another five-year term. Transdev Vice President and CEO of New Orleans operations, Justin Augustine, is a native of New Orleans and deeply committed to the City's success. Among his accomplishments have been major improvements in both quality of service and efficiency of operations. He has also pioneered training programs to develop young leaders and nurture a new generation of craftsmen and mechanics to support RTA's historic streetcars. The PPOP contract structure is a unique business model that has enabled the entire transit system to flourish, with Transdev bringing systems, processes, and innovations from its transit operations in 20 countries.

A commitment to integrating with the sharing economy

We view Transportation Network Companies (Uber, Lyft) and other sharing economy start-ups as an integral part of the menu of mobility options available to residents of New Orleans and as an important complement to the public transit system. The strategies outlined in this proposal will further this trend by establishing the city as a laboratory of innovation for mobility and sharing economy solutions.

A commitment to open data

In 2013, RTA released its General Transit Feed Specification (GTFS) on its website (www.norta.com) to create open machine readable data that application developers could use to create futuristic, user-friendly trip planning apps. The strategies proposed in these applications are designed to expand the public's capacity to use transportation data and to support the user's ability to make informed decisions. This proposal goes even further to leverage the power of the terabytes of data being generated typically by a Smart City.

Current data collection

The data currently collected by the city falls into five categories.

- Operational and maintenance
  - 311 calls for service data for road maintenance, signage repair, street light outage, etc.
  - Monthly census of operational streetlights (conducted by contractor)
  - Weekly tallies of potholes filled and catch basins cleaned. Potholes filled by "pothole killer" are geo-located.
- Road conditions
  - Department of Public Works is currently collecting data on street conditions
- Traffic safety
  - 911 calls for service for traffic-related incidents
  - State-maintained LACRASH database for all traffic, pedestrian, and bike accidents

- Taxi data
  - All rides for metered taxi rides in Orleans Parish
- Public transit data
  - Real-time automatic vehicle location data
  - Passenger counts for each route operated

Even as the City improves its data collection, we are committed to extracting its maximum value, having already united different city agencies in the review of this data to inform policy decisions.

The Mayor's office has instigated a new safety initiative that brings together the Police Department, the Department of Public Works, the Regional Planning Commission, and the Louisiana Department of Transportation. All of these agencies meet regularly to review safety data as part of a broader effort to align New Orleans with the ten U.S. cities selected as part of the Vision Zero Network.

Another City-led data initiative is our monthly Quality of Life statistic review meeting. Every month, the Mayor's Office, the Department of Public Works, the Sewerage and Water Board, Department of Parks and Parkways, the Department of Sanitation, the Mosquito, Termite and Rodent Control Board, and the City's Chief Information Officer meet to review 311 call data and analyze trends in citizen requests. Much scrutiny is given to the City's ability to respond to the requests and deliver the services and information citizens require.

Team Makeup and Capability to Execute

This proposal has been developed by a team of New Orleans public officials and leaders working with a group of international experts on Smart City technologies, building off the initiatives and programs we have begun over the past six years. Local team members include leadership from the City of New Orleans Mayor's office, the Department of Public Works, Network of Economic Opportunity, the Sewerage and Water Board, the Regional Planning Commission, the Port of New Orleans, the City Planning Commission, the New Orleans Redevelopment Authority, the Regional Transportation Authority, and the New Orleans Business Alliance.

We have partnered with cross-disciplinary experts in the Smart Cities field from all over the world. Our team includes Living PlanIT, the world's foremost provider of Internet of Things architecture solutions, based in London and Portugal, and the Canadian Automated Vehicle Center of Excellence, an internationally recognized thought-leader in the socio-economic impacts of AVs providing consulting services, information, analyses, recommendations and other support to all stakeholders who will be involved in the launch of AVs and/or who will be impacted by their arrival.

The city's transit operator, Transdev, leveraged its international subsidiary Cityway, a leading provider of trip planning technology and smart mobility solutions including dynamic bus services and virtual commuter routes. Transdev also tapped assets from its Paris-based Digital Factory team, an internal unit dedicated to researching the future of transportation and, in particular, AVs. As the current RTA operator for at least the next five years, Transdev brings a continuity of vision for the future of transportation in the City throughout the performance period of this grant.

Other team members include the University of New Orleans and Spartan Solutions, a leading transportation consultancy based in Washington, D.C. Silicon Graphics International, a world-leading data analytics solution provider, is a potential team member as well.

The city officials and team members assembled here have a proven track record of achieving improbable successes. Our team includes veterans of the post-Katrina rebuilding effort, who led the charge in bringing New Orleans back as a viable and desirable place to live. In 2013, the City, RTA, and Transdev completed the Loyola Streetcar expansion on schedule just before the Super Bowl thanks to funding from the USDOT. Since then, $2.7 billion of new transit-oriented development has occurred along this new expanded streetcar route. We expect similar results along the expansion currently under construction, scheduled to open late in 2016.

The top challenges New Orleans faces are similar to those of many cities: congestion, water management, inequality, urban rejuvenation and access to jobs. Additionally, our street network is often dense with small blocks and narrow lanes, especially near the most popular destinations, compounding congestion problems. The layout of the city, tucked between the Mississippi River and Lake Pontchartrain, prevents further outward sprawl. The city has sunk over seven feet since its founding 300 years ago, creating a myriad of challenges.

In other words, no city appreciates the challenge of doing more with less than New Orleans. Our proposal represents our best effort to optimize the infrastructure we have using data and technology, and an innovative plan to implement new infrastructure that will power the next century.

The attached letters from city councilmembers and local leaders demonstrate the commitment and the excitement that the entire city shares about our vision. We have total confidence in our ability to execute the plan described in this document, during the grant performance period and beyond. This grant represents an unprecedented opportunity to alter the City's trajectory for the years to come.

Technical, Institutional, and Policy Risks

Dreaming up new innovation and ideas is inevitably risky. We are confident in our team's ability to mitigate the risks associated with the following challenges.

Technical risks

Unproven AV technology – Establishing an AV demonstration zone in the city's center opens up opportunities for public safety concerns (AV software malfunction causing a pedestrian crash, for example).

Data privacy – The sheer scope of data generated by a Smart City poses new challenges. Even anonymized data carries privacy implications, as highly specific conclusions can be drawn for historical location data over time. Balancing this risk with our commitment to open data for all, we will work with international data science experts to navigate this challenge as we develop our proposal.

Unprecedented scale – A city-wide database operating system like the UOS has never been implemented on such a large scale. It is likely that the system will pose unforeseen challenges throughout its deployment.

Policy and institutional risks

Local level policy and institutional risks are minimal given widespread institutional buy-in and participation among key stakeholders and city officials. The letters of support attached to this proposal are evidence of this.

Our dynamic parking proposal has the potential to be controversial, as a recent $3/hour parking price imposition was extremely unpopular.

There is work to be done to implement an AV policy framework that is conducive to research and development. The city aims to base its guidelines off of the recommendations issued by USDOT over the course of this year.

Opportunities to Leverage Federal Resources

The City has multiple opportunities to leverage Federal resources.

First, the City is prepared to deploy assets like the UPT land and adjacent property under the Pontchartrain Expressway for the redevelopment of UPT as a mobility hub.

Second, the Sewerage and Water Board is in the process of administering large amounts of federal grants for related infrastructure projects that work in synergy with the Smart City efforts.

Third, City transportation partner Transdev has provided and is prepared to provide significant in-kind contributions to the project, including hundreds of man-hours of labor and the mobilization of digital assets from their global parent company.

Fourth, we plan to leverage private industry partners, including the hospitality and entertainment industries (which stand to benefit financially from the improvements outlined here) to assist with related capital outlays.

In addition, we will seek to obtain all available federal grants which offer funding in related areas. Another potential option is to re-allocate existing grants toward the Smart City effort.

Conclusion

Winning this grant would be transformational for our city. While we are proud of our current trajectory, a boost of this magnitude would allow us to make a quantum leap towards becoming a Smart City, as opposed to the incremental gains we are on a path to achieve.

We offer this document as a vision for the future of a resilient city. We are positioned to build the future city: one that is responsive to our delta and coastal geography, locally forged and globally connected, and founded on the equity of opportunity and social mobility.

Today, as we approach our 300th anniversary, we look toward the future and set a course for the city's fourth century, a future where every facet of the city runs in harmony with the others and where every citizen is empowered to live the life they choose. Our plan will also reduce congestion and our dependence on foreign oil.

We are excited and humbled by the opportunity to advance this vision through greater technical insight and understanding. It is our greatest hope that you will find this application aligns with the highest aspirations of the Smart City Challenge.

Table of Compliance

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3	Describe other characteristics of your city	25–28
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5	Describe how your holistic, integrated approach aligns to the twelve USDOT vision elements described in this solicitation	1
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7	Outline team partners, key stakeholders, and demonstration governance processes	28
8	Describe existing transportation infrastructure and system features in your city	26–27
9	Define the data your city currently collects	27
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11	Provide measurable goals and objectives for your vision	5–6
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13	Describe any opportunities to leverage Federal resources through cost share, in-kind donations, and partnering	29