

Q2 2019

PROGRESS REPORT

AUTONOMOUS VEHICLE TESTING
CITY OF BOSTON





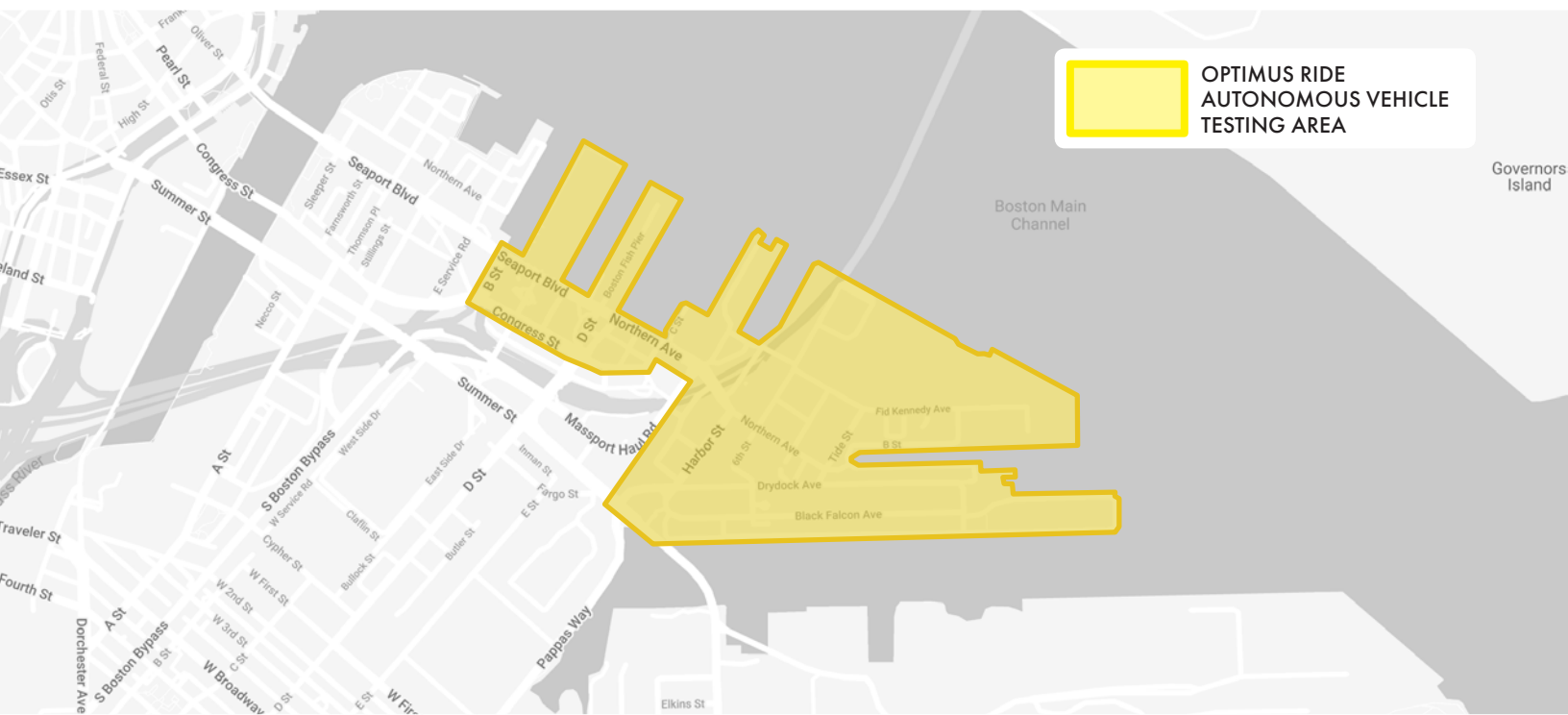
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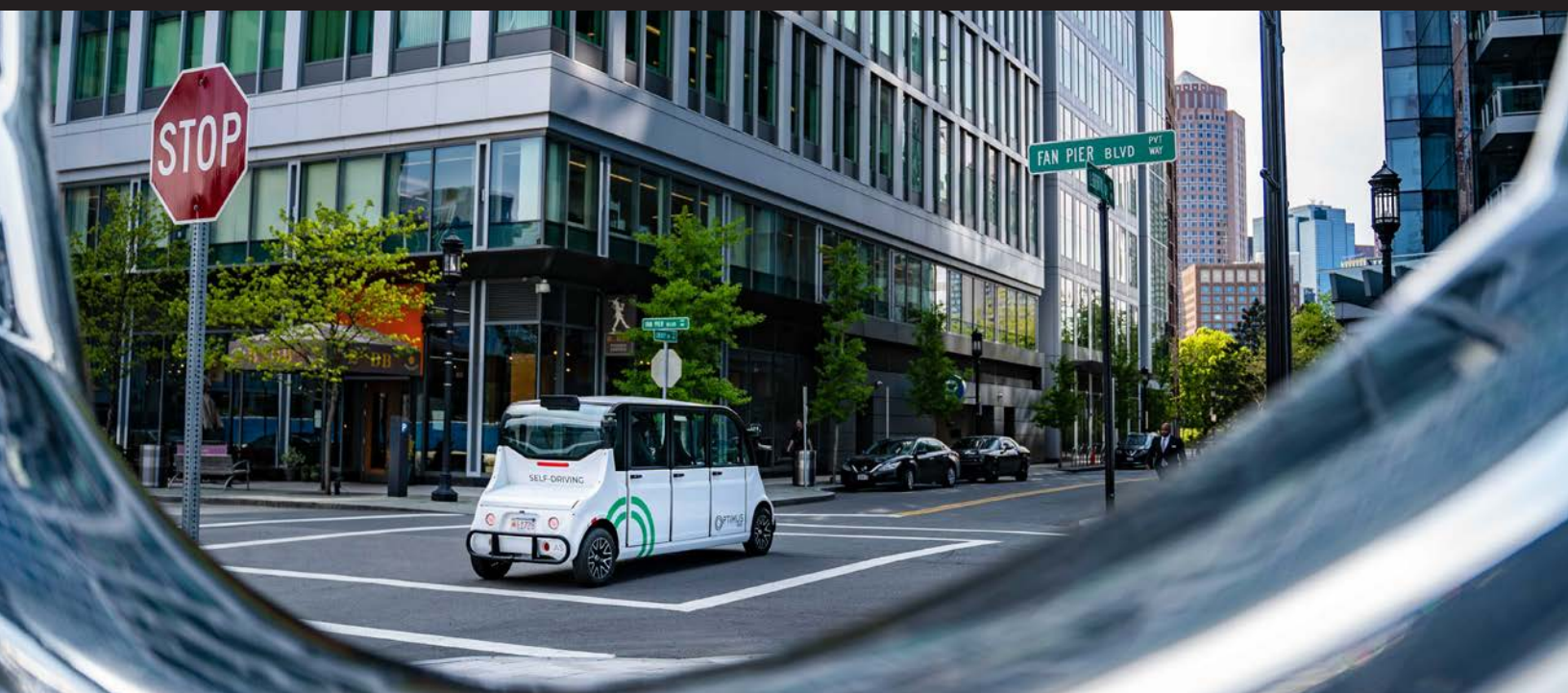
Optimus Ride Inc. is a self-driving vehicle technology company. Emerging from Boston's vibrant robotics ecosystem, we bring together the promise of self-driving technologies with real-world considerations. We design our software to enable efficient, sustainable, and equitable mobility solutions.

This document provides a quarterly update to the City of Boston and the general public on Optimus Ride's autonomous vehicle testing program.

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OPTIMUS RIDE TESTING OPERATIONAL DOMAIN





INTRODUCTION

Participating in the Autonomous Vehicle Testing Program established by the City of Boston and MassDOT enables Optimus Ride to explore the promise of autonomous vehicles to improve road safety, expand access to public transit, enhance sustainability, and promote economic growth. To date, Optimus Ride has driven over 3,000 miles autonomously on public roads in Boston and logged many thousands more in the state of Massachusetts.

Optimus Ride began testing its autonomous driving system on public roads in the Seaport in the summer of 2017 and have been operating our flagship commercial service in Weymouth, MA, since 2018. In the first quarter of 2019, we announced the launch of additional commercial programs in three communities across the United States: Halley Rise by Brookfield Properties in Reston, VA, the Brooklyn Navy Yard in Brooklyn, NY, and Paradise Valley Estates in Fairfield, CA.

This quarter, our R&D and manufacturing efforts have grown in step with these sites, supporting the safe and expedient growth of our operations. At the same time, research initiatives at our headquarters in Boston and our flagship site in Weymouth, Union Point, continue to teach us important lessons on the shared road and commercialization aspects of deploying autonomous vehicles to the general public. In this report, we'll describe advances to our technology and product offerings to provide a glimpse into the ways in which Optimus Ride is shaping the future of the autonomous vehicle industry.

We are continuously grateful to the State of Massachusetts and the City of Boston for enabling the development of the autonomous vehicle industry and for its support of Optimus Ride.

Thank you,
The Optimus Ride Team



RESEARCH & DEVELOPMENT

Foreword From Our Team

To understand the complexities of making self-driving vehicles a reality at each of our deployment sites, it is useful to think locally: what does a complex intersection or roadway look like in your neighborhood? Below, we'll analyze a single intersection near our Boston headquarters to describe the complexity of the technical challenges facing autonomous driving system development.

For our research and development program in Boston's Raymond L. Flynn Marine Park, the first intersection that comes to mind is the intersection between Drydock Avenue and Tide Street. In previous reports, we've described the challenges that this intersection poses for autonomous operation including occluded turns, parked vehicles, and various road occupants such as buses, cargo trucks, private vehicles, bikes, and pedestrians. Despite its high level of complexity, mastering this intersection autonomously is paramount: the intersection is a critical juncture in our route network, serving as our primary connection to the main Seaport District area through Northern Avenue and Seaport Boulevard and to Downtown Boston's primary artery over the Fort Point Channel, Summer Street.

The intersection can best be described as a "skewed" T-intersection, where vehicles diverge, merge, and cross at their own pace. As the intersection is not governed by a stop light, a stop sign was placed at its southeast corner earlier this spring with the intention of calming westbound traffic. For any human road occupants - whether a motorist or pedestrian - to proceed safely westbound down Drydock Avenue past the Tide Street intersection, at least three trajectories must be checked before moving: eastbound vehicles on Drydock turning right onto Tide, oncoming left-turning vehicles from Tide St. onto Drydock Ave., as well as a 360-degree check for other pedestrians, bicyclists, skateboarders, and so on. Once these checks are performed, a road occupant can typically proceed across the intersection safely.



Research Achievements

Since the announcement of our new deployments, we've been developing our driving system to respond to the features and quirks of its operating environments. This includes improving the maneuvering of intersections, like Drydock Avenue and Tide Street, and the navigation of constrained, complex spaces, such as parking lots.

Humans, as we know, have the capability to perform behavioral checks and inferences while driving with a high degree of accuracy. However, for fully autonomous driving systems to be deployed safely to the general public, the behavioral prediction capabilities of the vehicles for all road occupants must reach accuracy levels that supercede human capabilities. To reach that goal, our team is closely analyzing the roads we operate on to program our autonomous driving system to track, predict, and safely drive in harmony with other drivers.

Takeovers

The driver takeover methods used in the Optimus Ride vehicles have been designed to ensure the Human Machine Interface (HMI) is clear, consistent, gives context, and provides the necessary feedback about the system.

The system is designed to disengage autonomous control and enable manual control by the safety driver when a takeover is initiated. The safety driver can immediately take control using the brakes, throttle, or steering wheel. Takeover events occur largely due to environmental factors, such as unclear or faded lane markings. Examples of common takeovers during Q2 2019 include navigating around police officers who are manually directing traffic during boarding and unboarding at the Black Falcon Cruiseship Terminal.

Safety Record

Optimus Ride continues to foster a Safety Culture by maintaining and continuously improving the safety of our daily activities and overall operations record. We maintain an excellent safety record and have no accidents, failures, or disruptions of our vehicles to report.



MOBILITY SERVICE & COMMUNITY ENGAGEMENT

Community Engagement

In the past quarter, we participated in several events where community members had the opportunity to learn more about us. At the beginning of June we hosted a booth at the Robotics Summit and Exposition where attendees had the opportunity to chat with some of our engineers and members of our operations team. Later that month, we participated in an event in Cambridge related to urban mobility, where attendees had the opportunity to explore alternate methods of mobility such as neighborhood electric vehicles, bikeshares, and scooters. We look forward to meeting more community members and learning about how we can improve their mobility as we participate in these events.

Passenger Satisfaction

The safety and satisfaction of our passengers is our utmost priority. Key satisfaction metrics tracked by our team during the second quarter continue to indicate that our users gain value from our service and experience high levels of satisfaction, advancing our mission to increase access to public transit and improve overall mobility. To this end, we are commencing user studies to improve our passengers' experience from ride hailing to drop-off. These studies include exploratory research into the types of information passengers wish to see at various touchpoints in their experience, such as before the ride and once inside the vehicle. Ultimately, our user studies are contributing towards defining our vision for the development and commercialization of autonomous vehicles. We are enthusiastic to pave the way for the safe, sustainable, and equitable development of the autonomous vehicle industry.



