



QUARTERLY AV TESTING REPORT

3rd QUARTER 2018

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BACKGROUND

nuTonomy is an autonomous vehicle (AV) company. We are a part of Aptiv, a global mobility technology company. Our mission is to radically improve the safety, efficiency, and accessibility of transportation in cities worldwide. Since January 2017, we have been testing our AVs on the public roads in Boston. nuTonomy and the City of Boston have agreed to a Test Plan, which asks nuTonomy to report on our AV testing quarterly. This Report covers our progress during the Third Quarter of 2018.

In the Third Quarter, nuTonomy reached three milestones along the path towards AV deployment. First, in July, we announced a partnership with The Hertz Corporation and its fleet management subsidiary Donlen. Our collaboration with Hertz will allow us to operate and maintain autonomous fleets at scale, which is a prerequisite to deploying AVs in a commercial service. Hertz will start working with us on the operation and management of our AV fleet in Las Vegas, with the potential to expand to Boston and the other cities where Aptiv is testing AVs.

In August, nuTonomy announced that our AV passenger pilot with Lyft in Las Vegas had provided 5,000 autonomous rides to members of the public. The Las Vegas Lyft pilot built on our experience with the nuTonomy and Lyft pilots in Boston in the fall of 2017. Like the Boston pilots, the Las Vegas pilot is intended to demonstrate our technology to the public and to generate consumer feedback on the rider experience. In the initial 5,000 rides, the average passenger rating on the Lyft app was over 4.95 out of 5 stars.

In September, nuTonomy announced the preliminary release of nuScenes, a large-scale dataset for autonomous driving. This dataset includes 1,000 driving scenes of 20 seconds each. The scenes were chosen to showcase challenging locations, times, and weather conditions across Boston and Singapore. The final dataset, to be released in the spring, will include approximately 1.4M camera images, 400k LIDAR sweeps, 1.3M RADAR sweeps and 1.1M object bounding boxes in 40k keyframes. By releasing a subset of our data to the public, we hope to advance research in computer vision and autonomous driving. The rich complexity of nuScenes will encourage development of methods that enable safe driving in densely traveled urban areas.



SUMMARY

Miles Driven

As we stated in our Report in the Third Quarter of 2017, nuTonomy has exceeded the 600 autonomous miles required for Phases B1, B2, C1, and C2 of the Test Plan. As always, it is important to note that our autonomous driving in Boston represents a small fraction of accumulated autonomous mileage when including our operations in Las Vegas, Pittsburgh, and Singapore. But our autonomous driving in Boston is high leverage: the complexity of road conditions and the density of vehicles, pedestrians, cyclists, and other road users accelerates our research.

Locations Driven

During the Third Quarter, we operated our AVs in autonomous mode on streets in the Seaport and in the periphery of South Boston. Specific roadways include: A Street, Black Falcon Avenue, B Street, Bond Drive, Boston Wharf Road, Congress Street, Courthouse Way, Cypher Street, D Street, Dorchester Avenue, Drydock Avenue, E Street, Fan Pier Boulevard, Fargo Street, Harbor Shore Drive, Northern Avenue, Pier Four Boulevard, Richards Street, Seaport Boulevard, Sleeper Street, Summer Street, Tide Street, West 1st Street, West 2nd Street, and various small connector streets. Additionally, we operated our AVs in manual mode for data collection and mapping purposes throughout the remainder of the Seaport and South Boston neighborhoods. We also conducted testing in our closed course facility in the Boston area.

Crash Reports

We have not produced any crash reports, because our AVs have not been involved in any collisions during our testing in Boston.

Failures with Autonomous Mode

We did not experience any unanticipated failures with or disruptions while driving in autonomous mode. As we explain below in greater detail, in certain traffic scenarios our safety drivers take over manual control because of known limitations of the current state of AV software.



SUMMARY

Takeovers

nuTonomy's safety drivers take over manual control in any situation in which they feel uncomfortable or unsafe. During the Third Quarter, our safety drivers took over manual control of our AVs in the following situations:

1. when emergency vehicles were in active operation (e.g., sirens and lights activated) in the roadway;
2. when law enforcement officers were manually directing traffic in intersections through which our AVs were travelling;
3. in certain situations in which construction vehicles were obstructing our lane of travel;
4. in certain situations in which oncoming vehicles or bicycles violated lane boundaries; and,
5. when other vehicles were exhibiting erratic behavior near our AVs.

A safety driver's decision to take over manual control in a given situation does not necessarily indicate that continued autonomous operation in those situations would be unsafe. Because we instruct our safety drivers to err on the side of caution, we expect that takeovers will occur in many situations in which the AV would have handled the situation without incident. We are continuously improving our AV software, and we are confident that our AVs will be able to handle each of these situations without a takeover after further development.



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LEARNING

What We Have Learned

Since the beginning of nuTonomy’s public road testing program in January 2017, our AVs have had to manage ongoing construction in the Raymond L. Flynn Marine Park and the Seaport. In the Third Quarter of 2018, however, we saw an increase in the complexity of construction activity on and adjacent to the roads we are using for AV testing in the Seaport. In previous reports, we have explained that our safety drivers take over manual control in certain situations that construction zones create. In this Report, we would like to offer some additional detail on what we have learned by operating AVs through the Seaport’s construction zones.

At this stage of development, nuTonomy’s AVs can handle many construction zones in autonomous mode. They can identify traffic cones, jersey barriers, and other construction equipment, and maneuver around them—even if the maneuvers involve changing lanes. They can adapt to shifted lanes or other new traffic patterns. They can safely share the roadway with unwieldy construction vehicles.

But there are a few construction zone scenarios that predictably lead to takeovers. When a law enforcement officer is directing traffic, nuTonomy’s safety drivers will take over manual control to ensure that the vehicle follows the officer’s visual instructions. In some situations, safety drivers will take over when there are active construction sites on both sides of the roadway, and safe operation requires squeezing through a narrow, improvised route. Sometimes, construction zones can cause traffic patterns to change frequently enough that safety drivers will take over as precaution, because we have not yet determined that our AVs can navigate the new pattern successfully.

We thank Governor Baker, Mayor Walsh, Secretary Pollack, Commissioner Fiandaca and their teams for their continued support of our AV testing in Boston.

IMAGES

nuScenes images drawn from nuTonomy's testing in Boston

