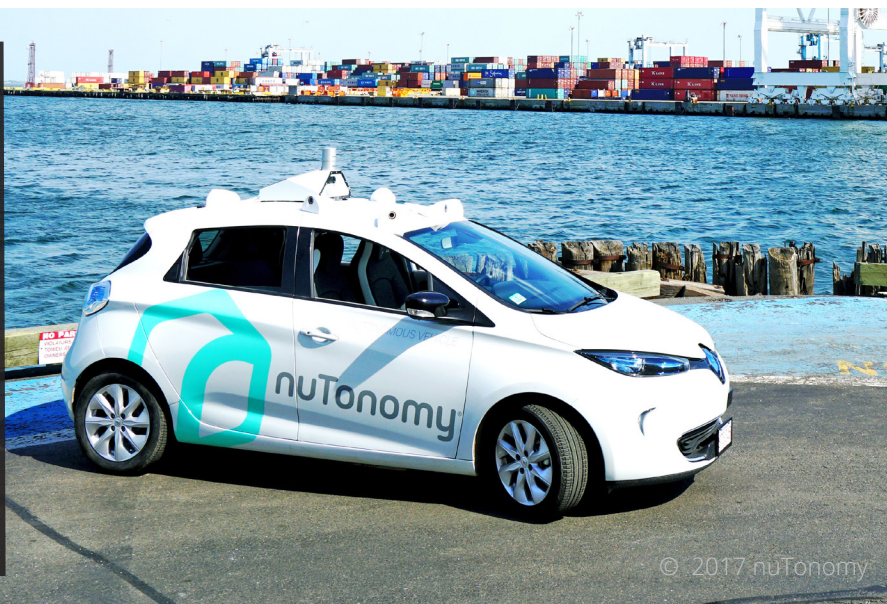


# NUTONOMY QUARTERLY AV TESTING REPORT

SECOND QUARTER 2017



## BACKGROUND

nuTonomy develops software for self-driving cars, or autonomous vehicles (AVs). We have tested our AVs on private tracks on three continents since 2014 and on the public roads in Singapore since the summer of 2016. In Boston, we have been testing our AVs on the public roads since January 2017. The City of Boston and nuTonomy jointly developed a phased Test Plan, in which nuTonomy agreed to report on our progress in testing each quarter.

This report documents nuTonomy's AV testing in Boston in the Second Quarter of 2017. For the first few weeks of the Second Quarter, our testing was limited to the Raymond L. Flynn Marine Park, as required in Phase B2 of our Test Plan. On April 24, the City of Boston approved nuTonomy for Phase C1 of the Test Plan, which allowed us to test our AVs throughout most of the Boston Seaport.

The newly expanded geography enabled us to dramatically increase the technical complexity of our testing in Boston. During the Second Quarter successfully operated our AVs on multi-lane roads, through signalized intersections, and sharing roadways with cyclists. Although we have long tested our AVs in comparable scenarios in Singapore, there is considerable variation in vehicle, pedestrian, and cyclist behavior between Singapore and Boston. Therefore, we have adapted our AV software to local conditions and incrementally increased its functionality and robustness.



## SUMMARY

### **Miles Driven**

nuTonomy has exceeded the 400 autonomous miles required for the completion of Phases B1, B2, and C2 of the Test Plan. Our autonomous driving in Boston represents a small fraction of the total amount of our autonomous miles driven globally, due to the larger fleet, operations team, and testing area we have available in Singapore. But we view our Boston testing as high leverage—each mile on the Seaport’s complex and traffic-dense roadways provides significant technical feedback for developing our AV software.

### **Locations Driven**

Since the City’s expansion of our testing area on April 24, we have been testing our AVs across the breadth of Boston’s Seaport. We routinely operate in autonomous mode on Drydock Avenue, Summer Street, Dorchester Avenue, Congress Street, and Northern Avenue. We have also tested our AVs on some smaller connector streets. We did not operate in autonomous mode on the Massport-owned section of Congress Street until we received Massport’s approval to test on those roads.

### **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/Disruptions While Driving in 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

As always, nuTonomy's safety drivers take over manual control in any situation in which they feel uncomfortable or unsafe. During the Second 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 violated lane boundaries; and,
5. when other vehicles were exhibiting erratic behavior near our AVs.

As always, it is worth noting that 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.



## LEARNING

### What We Have Learned

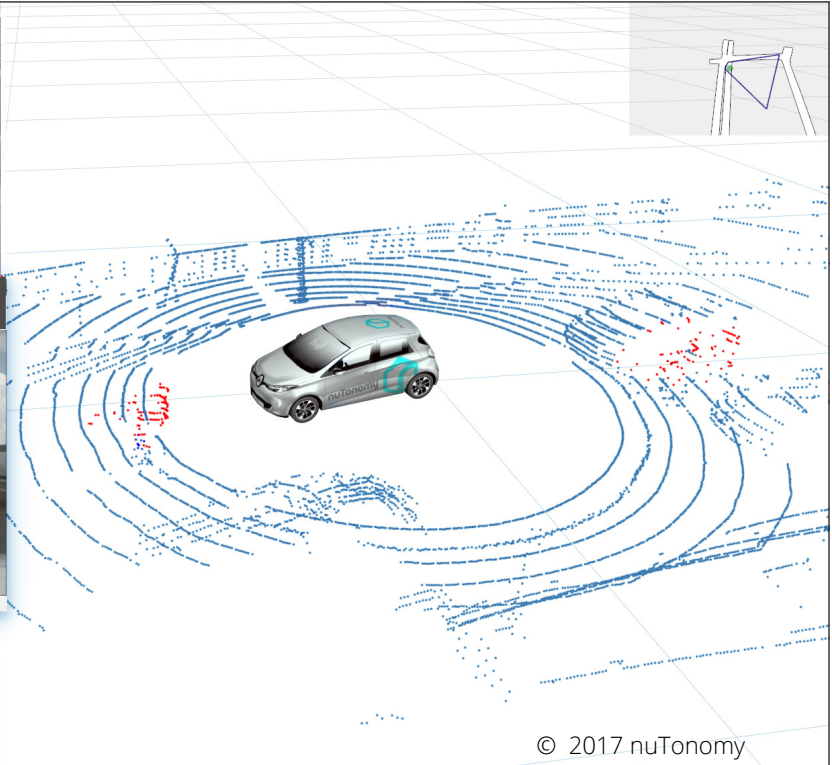
In the Second Quarter, nuTonomy's AVs encountered a range of technical challenges, mostly due to the newly expanded geography. Here are some examples:

1. Bridges: we routinely operate our AVs across the Summer Street and Congress Street bridges over the Fort Point Channel;
2. Boston's Traffic Signals: we have adapted our traffic light detection software, which we have been using to detect Singapore's signals, to Boston's traffic signals, which allows us to stop for, slow down for, proceed through, or turn through signalized intersections in autonomous mode;
3. Multi-Lane Roads: we have successfully operated on streets with two and three lanes of traffic in each direction—which we have long encountered in Singapore, but only now with Boston's vehicle behavior;
4. Double Parking: vehicles and delivery trucks are frequently double parked along the commercial sections of Seaport streets, which can create interesting lane change scenarios; and,
5. Pedestrian Traffic: the western half of the Seaport has dense pedestrian activity, and our AVs have successfully interacted with pedestrians in crosswalks and even jaywalkers in the roadway.

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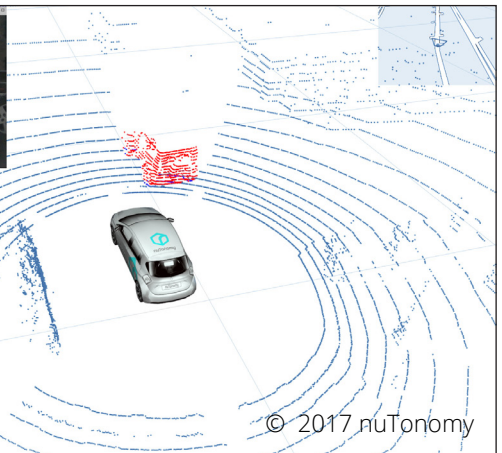
nuTonomy has recently requested that the City of Boston approve us for Phase C2 of our testing, which would permit us to operate in the expanded Seaport area in inclement weather conditions. We look forward to the City's response. As always, we thank Mayor Walsh and the City of Boston, Governor Baker and MassDOT, Massport, and the Economic Development and Industrial Corporation of Boston for their continued support for AV testing in Massachusetts.

# IMAGES



Our AV shares the roadway with some creative cyclists.

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Our AV is cut off in the middle of an intersection.

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