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 AV's 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 First Quarter of 2019.

The First Quarter of 2019 marked the second anniversary of our public road AV testing in Boston. In those two years, we have incrementally expanded our capabilities, our testing footprint, and our understanding of how passengers will interact with AVs. In this Quarter, we continued our public road testing in the Seaport and further exposed our technology to winter weather conditions. We also achieved two long-term goals: securing a closed course testing facility for the long-term and releasing the full nuScenes data set.

nuTonomy has tested our AVs in a variety of closed course environments over the past several years. By testing software updates first in a closed course environment, we can gain confidence that new software will perform well in public road testing. In the First Quarter, we reached a long-term agreement with the landowner of our closed course facility. The agreement allows us to have exclusive access to the facility and to make modifications to the site. We are planning to pave roads and build infrastructure that will serve as a more realistic model of an urban driving environment. In this emulated cityscape, we can practice difficult traffic scenarios while controlling the external environment.

At the end of the First Quarter, nuTonomy released the full nuScenes dataset. With 1,000 driving scenes of 20 seconds each, this dataset contains sven times more object annotations than the industry standard KITTI dataset released in 2012. The final dataset includes approximately 1.4M camera images, 400k LIDAR sweeps, 1.3M RADAR sweeps and 1.1M object bounding boxes in 40k keyframes. In these scenes, we annotate 23 object classes with accurate 3D bounding boxes at 2Hz over the entire dataset. Additionally we annotate object-level attributes such as visibility, activity and pose. We have released the nuScenes dataset free of charge for non-commercial uses. We are excited by the level of interest nuScenes has received from the industry and the academic community.

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. While our footprint in Boston is small, 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 First Quarter, we operated our AV's 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 AV's have not been involved in any collisions during our testing in Boston.

Failures with Autonomous Mode

We did not experience any unanticipated failures 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.

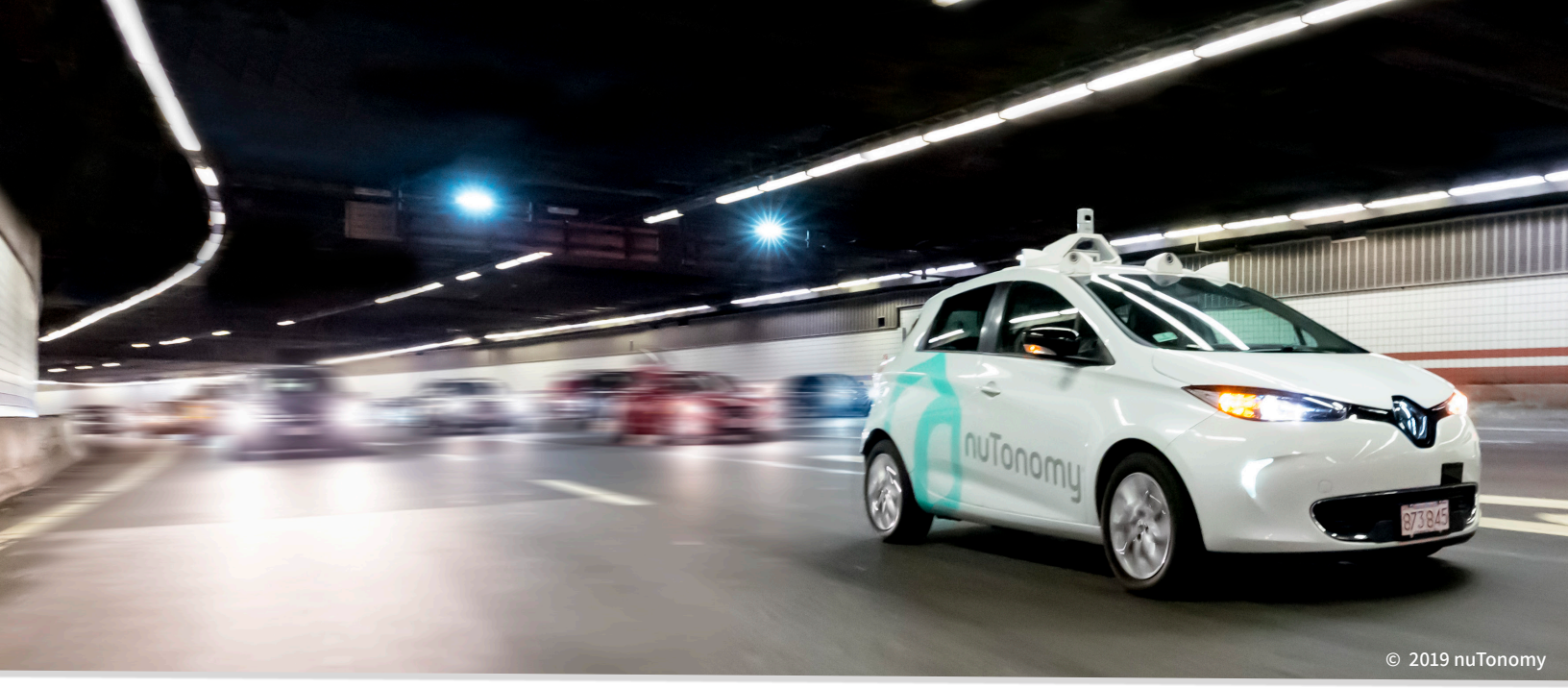
SUMMARY

Takeovers

nuTonomy's safety drivers take over manual control in any situation in which they feel uncomfortable or unsafe. During the First Quarter, our safety drivers took over manual control of our AV's 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 AV's 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;
5. in certain situations in which weather conditions deteriorate rapidly; and,
6. when other vehicles were exhibiting erratic behavior near our AV's.

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

Snow is a notoriously difficult driving condition for humans and AVs alike. This year was nuTonomy's third winter in Boston. In the winter of 2017, we were in the early stages of public road testing in Boston and largely avoided snow. In the winter of 2018, we conducted limited snow testing. This winter, we operated during light snowfall and with large snowbanks still present on the roadways.

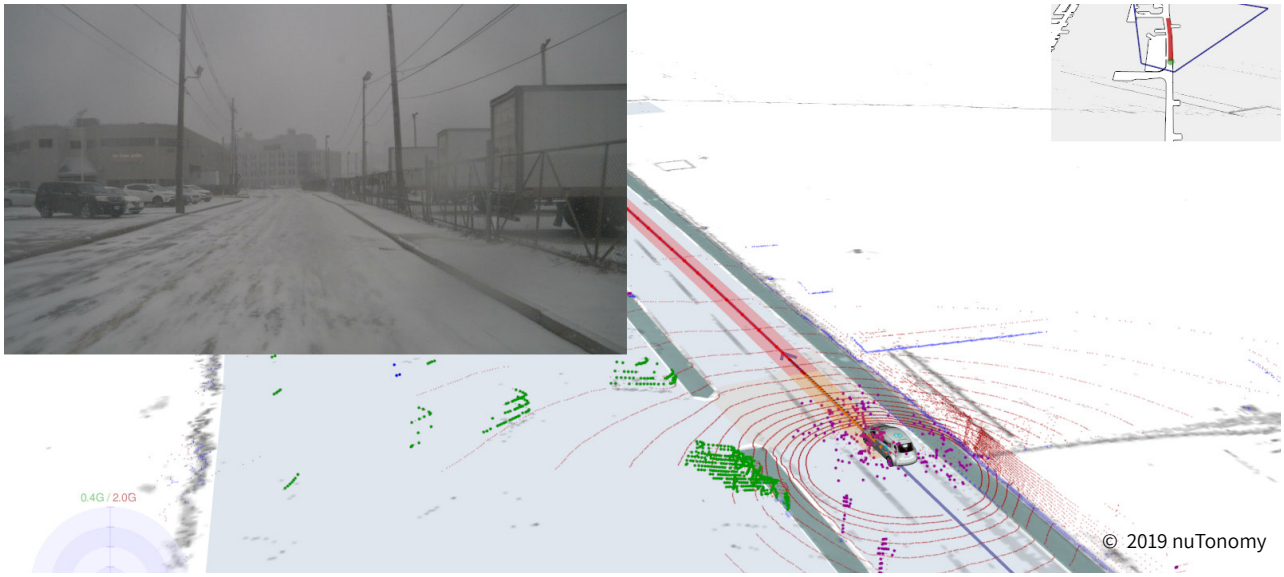
Falling or fallen snow can make AV operation difficult for several reasons, including but not limited to:

1. Perception - falling snow can occlude or otherwise interfere with sensors;
2. Landscape - snow accumulation on the roadway can alter the 3D topology of the environment;
3. Traction - friction with the road surface decreases, which can cause wheels to slip;
4. Driving Behavior - unpredictable behavior from other drivers increases (e.g., skidding, sliding, avoiding snow banks, not following marked lanes); and,
5. Object Types - unfamiliar vehicles share the roads (e.g,. plows, salt trucks, snow blowers).

We expect that it will take years before AV technology fully overcomes these challenges. The data we collect and the testing we conduct in our public road testing in Boston--together with our public road testing in Pittsburgh--gives nuTonomy and Aptiv significant opportunity to learn from extreme weather. More importantly, this testing brings us closer to deploying year-round an autonomous mobility-on-demand service in Boston.

As always, we thank Governor Baker, Mayor Walsh, Secretary Pollack, and their teams for their continued support of our AV testing in Boston. We extend a special thank you to Gina Fiandaca for her support of AV testing during her time as Transportation Commissioner of the City of Boston. We wish her the best in her next steps.

IMAGES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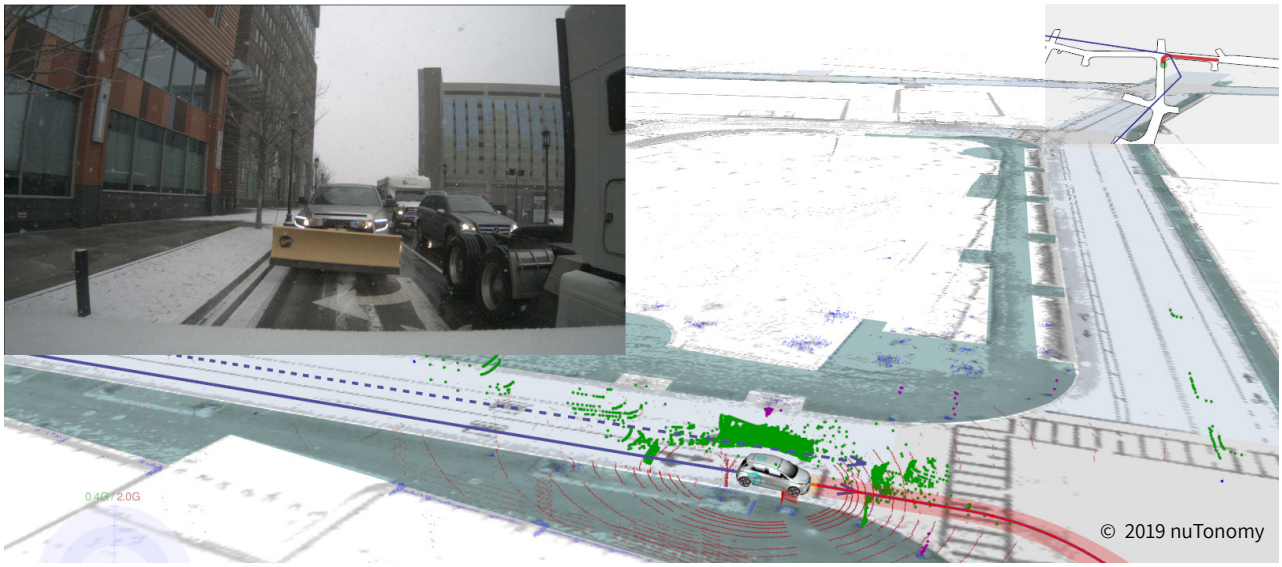
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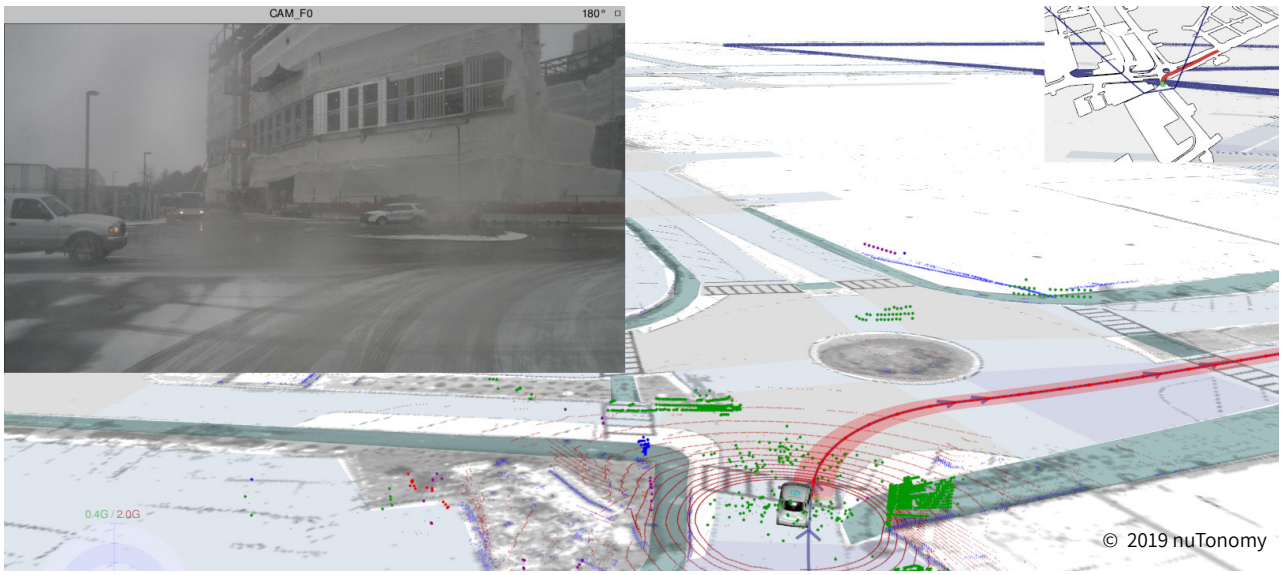
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