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Risk Management of Emerging Technologies

I. Autonomous Vehicle Technology and Developments

Land-Based Technology and Developments

While three of the most-recognizable names in automotive self-driving vehicle development are Waymo, Tesla, and Uber, we would like to start with a smaller operation that has already successfully deployed a series of fully autonomous mini-bus self-driving shuttle bus services. Designed for campus-based transportation, the Local Motors “Olli” vehicle was deployed at the White Rock Corporate Campus in the City of Rancho Cordova, California, a large business park with about 1,600 employees for a three-month pilot project designed to reduce single-occupant vehicle usage, from August to November 2019. The Olli vehicle is an all-electric, 3D-printed mini-bus that can be configured for eight passengers, capable of 25mph with a 25-mile range under full load and a 1.5-hour recharge time. The “Olli” will also be deployed in Clarksburg, Maryland as a shuttle bus between offices of Robotic Research LLC, pursuant to a Highly-Automated Vehicle (HAV) permit issued by the Maryland Department of Transportation, to continue research and testing of autonomous vehicle capabilities and technology on a half-mile stretch of public roadway. Local Motors has been participating in a series of deployments in:

- National Harbor in Maryland, in an expanded test deployment as of October 2019,
- Detroit, Michigan as one of five HAV providers for the 2020 North American International Auto Show in June 2020,
- San Francisco Bay Area for a “First Mile, Last Mile” commuter transit challenge at GoMentum Station as of October 2019,
- Peachtree Corners, Georgia, for a 1.5-mile autonomous vehicle testing track along Technology Parkway, servicing a series of retail shops and office buildings,
- And a series of other test deployments ranging back to 2015.

The scope of Local Motors technology may not be as far-reaching as what is under development by Waymo, Tesla and Uber for long-distance autonomous vehicle operations, but it is deployable now with present-day technology designed to be locally deployed and serviced via 3-D printing.

Uber announced in June 2019 a third-generation version of its self-driving car, developed in partnership with Volvo. The Volvo XC90 SUV will be factory-built to fit Uber's self-driving technology, to avoid the need of previous versions to retrofit. Uber expects to start testing on public roads in 2020. The car will have considerably more redundancy on backup systems, particularly steering, braking and battery power. Uber's design objective is to have the back-up system to immediately bring the car to a stop in the event any of the primary systems should fail. Uber has resumed testing as of December 2018, nine months after the Arizona traffic fatality to be discussed in greater detail later in this session.

Waymo has deployed driverless vehicles based on the Chrysler Pacifica minivan in the Phoenix, Arizona area, as in, no test operator behind the wheel. In late 2018, Waymo had launched "Waymo One," a limited public ride-hailing service available only to about 1,500 vetted customers participating in the beta tester rider program and covered under non-disclosure agreements with Waymo. The program is limited to about 50 square miles, and the vehicles cannot pick up or drop off passengers outside of the designated "geo-fenced" geographic zone. Waymo prefers to describe these trips as "Rider Only", not "fully driverless." Nonetheless, operations are continuously monitored by remote observers, who remain vigilant to provide guidance in case of ambiguous circumstances, such as a stopped moving van loading or unloading cargo. The onboard system does not yet recognize that in that context, the vehicle ahead will not be proceeding anytime soon; the operators then can remotely confirm to the onboard logic that passing the vehicle is appropriate. Published reports indicate that the ride performance is considerably improved since the initial rollout in 2017, but work is ongoing to achieve full autonomy.

Tesla is focused on developing their Autopilot driving-assist feature of their electric cars into a fully autonomous capability as technology improves. The latest improvements include more advanced sensor suite with better coverage, including eight cameras designed to monitor a full 360 degree circle of visibility, with up to 250 meter forward monitoring, 50 meter rearward monitoring, 100 meter rear lateral monitoring and 60m forward lateral monitoring, coupled with twelve ultrasonic sensors with an 8-meter range, and a forward-facing radar system reaching up to 160 meters to cut through rain, fog, dust and forward obstructions. At a speed of 70 mph, that translates into a response time of nearly 8 seconds in visual spectrum, 5 seconds via radar, if approaching a stationary object (less braking time). Tesla has not included any lidar (laser light detection and ranging) sensors in this sensor suite, a technology that Uber and Waymo relies upon.

Tesla's enhanced onboard computing systems touted to be forty times more powerful than prior models, however Tesla will point out that "Current Autopilot features require active driver supervision and do not make the vehicle autonomous." Autopilot does enable your car to steer, accelerate and brake automatically within its lane, and does have some additional navigation software tied to it to steer a vehicle towards highway interchanges and exits based on destination. That feature has had some unfortunate consequences, however, as we will discuss later in this session.

Daimler Trucks and Torc Robotics have started public road tests of self-driving truck systems in southwest Virginia as of September 2019, to operate under limited conditions ("Level 4" autonomy on the SAE International scale), with a CDL-carrying safety driver and systems engineer aboard.

In Gothenburg, Sweden, Volvo Trucks has deployed their "Vera" electric, connected and autonomous vehicle, designed for short-distance transport of truck trailers within logistics centers, factories and ports. Vera is designed to replace the tractors used to jockey trailers within those centers, and several have been deployed within a DFDS logistics center to transport to APM Terminals port facility there.

Sea-Based Technology and Developments

While most public attention is focused on land-based autonomous vehicle developments, there have been significant advances and deployments at sea. In December 2018, Rolls-Royce and Finland's state-owned ferry operator Finferries deployed the autonomous car ferry "Falco" between Parinen and Nauvo, demonstrating not only the ability to conduct the voyage under fully autonomous control, including navigation and automatic berthing systems, achieved without any human intervention by the crew. Situational awareness was maintained through a combination of on-board sensors relayed to Finferries' remote operating center in the city of Turku, some 30 miles away.

C-Job Naval Architects is developing an underwater maintenance dredger for in-port maintenance, which would require significantly less power than a conventional dredger. By submersing the dredger, C-Job was able to demonstrate that less than 55% propulsion power and 80% less dredge pump power would be needed than a conventional Trailing Suction Hopper Dredger and contains the same hopper volume for 80% of the vehicle length.

Maritime UK Autonomous Systems Regulatory Working Group (MASWRG) has launched an updated third version of the Industry Code of Practice for Maritime Autonomous Surface Ships (MASS). The code is not enacted as maritime law, but instead serves as guidance for manufacturers, service providers and others in this field, intended to replace the 2016 Code of Conduct and Version 2 of the 2018 Code of Practice, adding new sections on inland waterways. See https://www.maritimeuk.org/media-centre/publications/maritime-autonomous-surface-ships-industry-conduct-principles-code-practice/

The Saildrone unmanned surface vessel "SD-1021," a 23-foot (seven meter) long unmanned surface vessel completed a 68-day transatlantic crossing on October 22, 2019, arriving in Newport, Rhode Island after setting out from Lymington, UK. Originally launched from Newport in January 2019 on a science mission to measure heat and carbon in the Gulf Stream, the SD 1021 stopped in Bermuda for maintenance then set sail following the Gulf Stream to Solent, England. The SD 1021 not only holds the record for the fastest unmanned Atlantic crossing, but is the only MASS known to have completed a crossing in both directions.

IBM has teamed up with ProMare to develop the Mayflower Autonomous Ship, a full-sized self-navigating vessel intended to cross the Atlantic in September 2020, on the 400th anniversary of the original Mayflower voyage. The vessel will carry three research pods containing sensor arrays and scientific instrumentation for such missions as marine mammal monitoring, sea level mapping and ocean plastics monitoring, and work will be coordinated by the University of Plymouth, UK.

Air-Based Technology and Developments

On October 2, 2019, United Parcel Service secured approval from the U.S. Federal Aviation Administration to operate unmanned aircraft delivery systems to deliver medical packages at campuses around the country, expanding nationwide a medical delivery service first developed with Matternet to delivery lab specimens and transplant organs to WakeMed Hospital in Raleigh, North Carolina. The pilot program had launched in March 2019.

This was followed by Alphabet's Wing commencing the first commercial drone deliveries in Christiansburg, Virginia on October 18, 2019. Rather than locating initial operations in urban settings, Christiansburg is a small town of 22,000 located in the Blue Ridge Mountains, with no high-rise buildings and few obstructions, more easily serviced from Wing's "Nest" in North Christiansburg. Wing is delivering packages for FedEx, Walgreens and a local retailer Sugar Magnolia, who reported that one delivery was made to a customer's home eight minutes after calling in their order. Walgreens orders are available from six ready-made packages or may be selected online for up to three pounds in cargo weight. Wing drones have a three-foot wingspan, weigh just over 10 pounds, and can fly at speeds up to 70 mph. The aircraft has extra motors to prevent falls, and all flights are overseen by certified pilots. Packages are delivered via 23-foot tethers lowered to delivery sites, rather than landing the aircraft.

While Amazon Prime Air made its first delivery in Cambridge, England on December 7, 2016, Amazon is still working on obtaining approval from the US FAA for operations within the United States at this time.

II. Semi-Autonomous Vehicle Accidents to Date

Uber Advanced Technical Group

The most notable semi-autonomous vehicle accidents to date involve the five Tesla Autopilot traffic fatalities and the highly publicized Uber autonomous test vehicle fatality in Arizona. There have been aerial drone accidents as well resulting in injury and property damage, with far less attendant publicity.

The NTSB published reports in November 2019 regarding the Uber Advanced Technology Group (Uber ATG) autonomous vehicle accident of March 18, 2018 in Tempe, Arizona. (See https://www.ntsb.gov/investigations/AccidentReports/Reports/HWY18MH010-prelim.pdf)

In his opening statement, the NTSB Chairman Robert L. Sumwalt pointed out that the pedestrian who lost her life in the incident was pushing a bicycle across the street mid-block was "at particularly high risk of being struck, regardless of the striking vehicle." The accident occurred shortly before 10pm, and the pedestrian was dressed in dark clothes with no reflectors visible on the bicycle. Toxicology test results for the pedestrian were positive for methamphetamine and marijuana.

The Uber test vehicle, a modified 2017 Volvo XC90 operating with a self-driving system that was in computer control mode, was traveling at 39 mph at the time of the collision. Posted speed limit was 45 mph. The system consisted of forward and side-facing cameras, radars, LIDAR, navigation sentons, and a computing and data storage unit integrated into the vehicle. Uber had also equipped the vehicle with an aftermarket camera system mounted on the windshield and rear window which provided additional front and rear videos, along with an inward-facing view of the vehicle operator.

The Volvo XC90 was factory-equipped with several advanced driver assistance functions by Volvo Cars, the original manufacturer, including a collision avoidance function with automatic emergency braking. All Volvo driver-assist functions were disabled whenever the test vehicle was operating in computer control mode but enabled when operated manually.

According to data obtained by the NTSB from the self-driving system, the pedestrian was first observed about six seconds before impact, when the vehicle was traveling at 43 mph. The system software identified the pedestrian first as an unknown object, then as a vehicle, then as a bicycle, with various projected future paths. The NTSB report noted that “at 1.3 seconds before impact, the system software determined that an emergency braking maneuver was needed to mitigate a collision.”

Uber did not have emergency braking maneuvers enabled, in order to reduce the potential for erratic vehicle behavior. The vehicle operator was expected to intervene and act, but the system was not designed to alert the operator. The operator was looking down at the console, monitoring the self-driving system interface, as depicted in the video released in news reports on this crash. The record showed that with less than a second to react, the operator tried to steer clear of the pedestrian.

As a result of this accident and the ensuing investigation, the state government of Colorado revoked Uber’s permission to conduct autonomous vehicle testing in that state. Uber voluntarily shut down all such testing for nine months while investigations continued, and resumed limited testing in the Pittsburgh, Pennsylvania area thereafter.

Tesla, Inc.

On May 7, 2016, a Tesla Model S electric-powered sedan operating in Autopilot “Advanced Driver Assistance System” (ADAS) mode drove into a white-paneled trailer that was crossing the highway, in Williston, Florida. Visibility was clear, and witnesses reported that the tractor-trailer had been moving slowly as it made a left turn off the highway at an intersection, but that the Tesla vehicle and its driver had enough time to react to avoid the collision. The Tesla driver was killed in the crash, and the subsequent NTSB investigation determined that the driver had ignored warnings from the console to place his hands back on the steering wheel. The Tesla Autopilot system did not properly identify the obstruction the trailer posed, and the brakes were not applied.

In Handan, China, a similar accident was reported on September 14, 2016 by Chinese state media as having taken place on January 20 of that year. The Tesla Model S vehicle was reportedly in Autopilot mode, which Tesla reported as having not been independently confirmed. Footage from the dashboard camera released in the Chinese news report shows the vehicle driving into the rear of a road-sweeping truck, killing the Tesla driver. Tesla acknowledged the accident but said it could not confirm whether Autopilot played any role.

On January 22, 2018, a Tesla Model S on Autopilot crashed into a firetruck on a California freeway, where firemen were working a freeway accident. Fortunately, there were no injuries from this accident.

On March 23, 2018, a Tesla Model X SUV with Autopilot engaged slammed into a concrete median barrier without activating the brakes or steering clear. Another Tesla owner later driving through the same stretch of road videotaped his vehicle’s Autopilot starting to swerve into the same divider. Tesla reportedly had shifted Autopilot’s primary sensor to a forward-looking radar system to prevent the type of accident that occurred in Florida in 2016 but said that the road markings on that stretch of highway may have confused the software.

On May 11, 2018, in South Jordan, Utah, a Tesla Model S operating in Autopilot mode failed to detect a group of stopped vehicles ahead, and proceeded to accelerate into a firetruck when the vehicle that had been in front of the Tesla shifted one lane to the left. The Tesla driver tried to brake manually but was not able to prevent the collision. The Tesla driver suffered a broken ankle, the firetruck driver sustained whiplash injuries (but opted not to go to a hospital).

On August 25, 2018, a Tesla Model S on Autopilot crashed into a stopped firetruck in San Jose, California. The two occupants sustained minor injuries, and the driver was arrested on suspicion of driving under the influence of alcohol. The NTSB later confirmed that Autopilot was engaged at the time.

On March 1, 2019, at about 6:17am EST, a 2018 Tesla Model 3 in Delray Beach, Florida struck a tractor-trailer about 10 seconds after the Tesla driver engaged the Autopilot ADAS and took his hands off the wheel. Neither the Tesla driver nor the ADAS took evasive action or engaged the brakes, and the driver died as a result of the crash – which had sheared off the roof in an accident seemingly identical to the May 7, 2016 accident.

On September 17, 2019, in Osceola County, Florida, a 2019 Tesla Model 3 was traveling westbound when it veered into the eastbound traffic lane and hit a vehicle head-on, killing the Tesla driver. The family of the driver is pursuing an investigation with Tesla as to whether the Autopilot or lane-assist features were engaged at that time.

Unmanned Aircraft Systems

On September 12, 2017 at about 7:20pm, a Sikorsky UH-60M Black Hawk helicopter on patrol along the Hudson River suffered a midair collision with a DJI Phantom 4 video drone near Hoffman Island, New York Harbor that was operating at an altitude of 300 feet within temporarily restricted airspace. The drone operator was operating beyond visual line of sight, in violation of FAA regulations, but had been relying on a feature of his DJI control panel to determine whether he was operating in restricted airspace. The manufacturer DJI had reportedly disabled updates to this feature without notifying customers. The Black Hawk helicopter suffered a cracked rotor blade and some minor damage, the drone was destroyed but a serial number retrieved from a part found in the Black Hawk carburetor afterward permitted identification of the drone operator responsible.

On October 12, 2017 in Quebec City, Canada, Sky Jet Flight SJ512, a King Air A100 8-passenger commercial plane, collided with an unidentified drone within 5 km of the airport on approach for landing. There were no injuries, and negligible damage to the King Air aircraft.

On February 9, 2018 in Kauai, Hawaii, a Blue Hawaii Kauai tour helicopter collided with an unidentified drone while touring over a nature preserve. No injuries, negligible damage.

On February 11, 2018 in Charleston, South Carolina, an R22 helicopter during an instructional landing was intercepted by what is believed to have been a DJI Phantom video drone. The instructor pilot took control of the helicopter and engaged in evasive maneuvers which resulted in a crash that totaled the aircraft. The NTSB has been unable to verify the incident.

From December 19 to December 21, 2018, unidentified drones flying in the vicinity of Gatwick Airport in West Sussex, England resulted in over 1,000 flights being grounded, and hundreds of flights being cancelled as a result.

On December 24, 2018, flights at London Heathrow Airport (Longford, England) were halted for one hour when a drone was spotted near the northwest runways. An arrest was made.

On January 22, 2019, at Newark Liberty International Airport in Newark, New Jersey, landings were halted, and planes diverted for over one hour after pilots on two different planes observed a drone flying at an altitude of 3,500 feet during landing approach, near Teterboro Airport.

U.S. Federal Aviation Authority flight regulations prohibit operating unmanned aircraft systems at an altitude over 400 feet, at night or beyond visual sight, without a specific exemption issued by the FAA. The proposed drone-based delivery systems all require such special exemptions.

III. Impact on Insurance Industry

Insurance Carrier Concerns

According to the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS), in U.S. road travel of over 3,212 billion miles in 2017, more than 37,000 persons were killed due to vehicular accidents, of which nearly 18,700 were drivers. If autonomous vehicle technology can deliver on the promise of safer transportation, the risk landscape for automobile and commercial transportation insurance could change considerably.

According to a recent article in the trade journal "Carrier Management," most carrier executives consider autonomous vehicles as the insurance industry's most likely destabilizer in an insurance segment that had grown by 17.7% between 2011 and 2016.

The sheer volume of prospective usage data from increasingly connected vehicle populations may give rise to a new trend in automobile insurance: extreme personalization of automobile insurance coverage tailored to each insured's individual usage and behaviors. Adaptive policies that incorporate low mileage traveled annually with lower-speed, safe driving habits in low-accident areas, could provide an opportunity to offer lower insurance rates for lower individual risks, leading to greater market segmentation and a competitive advantage to current standard coverage terms and policies.

The rising tide of advanced driver-assistance systems, such as lane-following semi-automatic steering, adaptive cruise control systems that monitor proximity to cars ahead, emergency collision avoidance and braking systems, all are beginning to impact the risk inherent to travel by personal automobile or truck, across a widening realm of conditions.

While the trend towards increasingly sophisticated driver-assistance systems presage autonomous vehicles, after years of development and billions of dollars in research, fully-autonomous vehicles are not quite here just yet, but the trend is clear and the resulting risk reduction will need to be reflected in future coverage premiums as the driving risk profiles shift from individual drivers to automated systems. BMW and Swiss Re have already developed a vehicle-specific insurance rating system that scored the effects of driver-assistance systems on the safety of current BMW vehicles to facilitate calculation of individual vehicle-specific insurance premiums.

Mobility as a Service (MaaS) is also a rising subsector, with the emerging trend of car subscriptions and ride-hailing. BMW has already established a captive insurance company for their subscription service, which includes maintenance, roadside assistance and insurance.

Risk Management

Self-driving cars and trucks should never get drowsy, distracted or drunk. If no person is operating the vehicle, who is liable in the event of a loss? Volvo has taken an early stance with respect to such vehicles. "Volvo will accept full liability whenever one of its cars is in autonomous mode."

This represents a potential shift away from insuring the human driver, and a move to insuring the developer of such self-driving systems, with a constellation of potential claims in the event of a loss. Better understanding how specific technologies are changing the risk attached to a vehicle.

One clear priority, however, is developing the systems to cope with the prospective onslaught of real-time data such systems will generate. Otherwise, access to these risk pools may go to those carriers prepared to better support this Brave New World.

Investigation Impacts

The autonomous driving technology may be dazzling, but at the end of the day when there is a claim, you still will need to investigate. How will this change, as more vehicles adopt greater levels of autonomous operation?

The purpose of an investigation into the facts of a claim is to establish the liability to the injured party/claimant. To accomplish this, the degree of negligence attributable and the extent to which that negligence caused or contributed to claimant's injuries and damages needs to be determined. Better yet, establishing the lack of any negligence.

So, what remains the same?

- Verification of insurance coverage is one element that will remain the same. Determining whether claimant may not be covered, and the ensuing need for a reservation of rights, will not change with autonomous vehicle technology.
- Identification and interviews of initial contacts. The need to identify the client, carrier, insured, claimants, attorneys, witnesses, and more will remain the same, regardless of the technology.
- Similarly, the need to obtain police reports, photographs and diagrams, maintenance logs, surveillance footage, and other evidence requires individual attention.

Where can we expect improvements in the process from this new technology?

- Electronic Log Devices (ELD) can provide considerable telematics data currently, and the semi- and fully autonomous driving systems will have comparable tools and data repositories to access. For some fleets, a Transportation Management System (TMS) may also be available to integrate directly into an ELD and other safety telematics for additional data capture.
- Onboard cameras may also allow a near real-time review of an event.
- Finally, a telematics review of such elements as lane departures, speed vs. posted speed, hard braking, and similar activities can provide valuable information when determining liability.