

MARCH 2019

# AUTONOMOUS

VEHICLE ENGINEERING™

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## Ford's Autonomous Future

Sherif Marakby's team is leading the Blue Oval toward its 2021 self-driving debut.

**Radar  
Developments**

**Get to  
Know Veoneer**

**Thermal Simulation  
for AVs**

# Contents

## 2 Editorial

## 4 The Navigator

## 6 SAE AV Activities

A listing of SAE International's autonomous vehicle-related offerings across the organization.

## 8 Autonomy for the Masses

Ford Autonomous Vehicles LLC aims to do for AVs what the Model T did for just about everyone. CEO Sherif Marakby explains.

## 14 Speeding Thermal Analysis for Autonomous EVs

Solving thermal challenges is vital to AEV development. Siemens PLM's new Simcenter integrated simulation package offers a high-fidelity, easy-to-use solution.

## 18 New Mobility's Mega-Mappers

Most believe ultrahigh-definition mapping is crucial to make high-level automated driving possible. Developing these maps is a huge undertaking—one that's enjoying a massive investment of money and talent.

## 22 From a Blip to a Boom

Automotive radar rides the 77-GHz technology wave toward greater capability and vehicle safety.

## 26 The Swedish Word for AV Tech

Veoneer, a new Tier 1 supplier with well-established roots, is moving rapidly into AI, says veteran research boss Ola Boström.

## 28 Safety Testing for AVs is Just Beginning

There is much work to be done in creating accurate, reliable tests for occupant crashworthiness tailored to new AV designs and seating configurations.

## 30 Industry Unsettled on Vehicle Connectivity Standard

As data and data-sharing become more crucial to the transportation evolution, the auto sector has yet to gain consensus on the best connectivity format.

## 32 Road Tested

Transportation-infrastructure expert Kirk Steudle reflects on the rapid progress toward the connected-AV future and the challenges ahead.

## 34 Modeling the Road Ahead for AVs

Detailed virtual environments are vital to developing, testing and validating autonomous systems.

## 36 Is the Future of Aerial Autonomy Up in the Air?

As autonomous-drone and air-taxi concepts debut, legal hurdles will need to be cleared before the skies are automated.

## 38 Autonomy Meets Agronomy

John Deere sows some autonomy ideas at CES 2019.

## 40 Upcoming, Ad Index



Sherif Marakby, CEO of Ford Autonomous Vehicles, is confident his company's first self-driving production vehicle will debut in 2021. He is photographed inside 'The Factory' on Michigan Ave. in Detroit's Corktown district. Photo by Keith Tolman/VIS Alliance.

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# Is the Future of **Aerial Autonomy** Up in the Air?

by Jennifer Dukarski

As autonomous-drone and air-taxi concepts debut, legal hurdles will need to be cleared before the skies are automated.

**Autonomous vehicle technology literally has** nowhere to go but up. At CES '19, more than 170 exhibitors showed aerial drones of various shapes and sizes. Potential use cases for these devices appear to be limitless, but technical, legal and regulatory hurdles must first be overcome.

Drones are categorized by vehicle weight. The small devices weighing between 0.55 and 55 pounds (.25 kg to 25 kg) are known as Unmanned Aircraft Systems (UAS) and are lightly regulated. Drones exceeding 55 lb are regulated as traditional aircraft. Operators must obtain proper registration, licenses and certification for airworthiness.

Drones have a foothold in today's aerial-vehicle marketplace—but air taxis are not far behind. One of



Retail juggernaut Amazon has promised it will launch some form of aerial drone package delivery to augment its traditional ground-based service.

the most impressive CES displays was the Bell Nexus, an air taxi concept that is claimed to be capable of carrying five passengers up to 150 miles, at speeds up to 150 mph (241 km/h). Initially designed to have a human pilot, the Nexus is an eVTOL—hybrid-electric vertical take-off and landing craft. It employs a single gas turbine to generate electricity for six tilting ducted fans and their batteries.

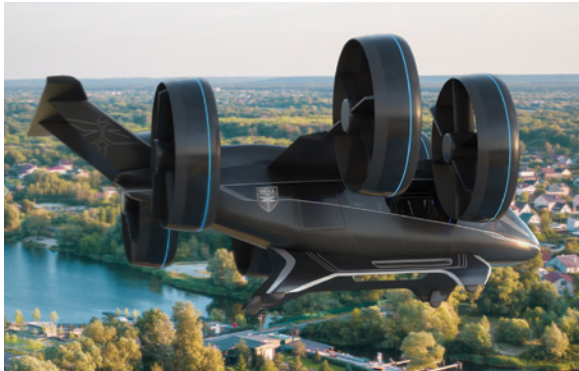
Bell is aiming for \$0.50-per-mile operating costs for Nexus. It is partnering with Uber to create a network of city-based flying taxis as a ride sharing service. At least 19 companies are developing similar products. Many are approaching the “on-demand aviation” market with eVTOL or conventional VTOL solutions to minimize problems in crowded cities. However, making VTOL a reality will require additional infrastructure and air-traffic control. Some facility options include vertiports (hubs with the ability to take off, land and charge) and vertistops (a single landing pad) that require only discrete locations rather than converting an entire roadway or traffic system.

## Legal challenges for aerial autonomy

Significant time is being dedicated to mitigating the legal risks of drone delivery services. As these devices are typically sized according to their design payload, heightened regulation is expected for the drones themselves and their operators.

Amazon

Both images: Bell



The Bell Nexus, a vertical-takeoff-and-landing (VTOL) air-taxi concept revealed at CES 2019 is powered by a hybrid-electric propulsion system incorporating six tilting ducted fans.

Privacy rights have also entered the discussion. One relates to surveillance; drones may capture images as they deliver their packages. There are also the myriad risks of drones trespassing on private property, colliding with other aircraft, or with ground vehicles and people, and otherwise causing damage and public nuisance. As the world saw recently with illegal drone activity at major U.K. airports, it is likely that more such issues will make headlines as companies begin to employ this technology in new ways.

Air taxis, by comparison, would live under the current regulatory schemes set by the U.S. Federal Aviation Administration (FAA) and European Aviation Safety Agency (EASA) and a few others. Autonomous VTOL systems will face their first challenge when regulators agree to the set of rules that apply to general aviation aircraft. They will need to be certified under Federal Aviation Regulation Part 21.17(b)—the FAA’s type certification for very light aircraft—to demonstrate an “equivalent level of safety” as proven in an experimental program.

This certification, unlike the self-certifying regime used by the ground vehicle industry, confirms that an aircraft is manufactured to an approved design and complies with airworthiness requirements. After accepting or addressing any missing standards, the airplane definition and detail definition phase begin. Then the craft is built and tested. Upon completion, it moves to certification.

This process can cost millions and require significant time to achieve. Boeing’s eVTOL made its first autonomous test flight in January 2019, hovering for under a minute. Airbus followed suit the same month. Experts predict that production-ready VTOL craft will be available as early as 2020, but development is still in the early stages and certification challenges loom.

## Looking forward

Proponents like Uber believe that the design of any VTOL must be safer than driving a car when considering a fatality-per-passenger-mile (FPPM) basis. Indeed, Uber suggests that the target should be one quarter of that found under the current regulations. Under FAR Part 135, statistics show that operations of small commuter flights tend to have twice the fatality rate of privately-owned ground passenger vehicles. Uber advocates that VTOL air taxis should cut this number to half the ground vehicles’ FPPM.

To achieve this and to mitigate safety risks, systems must be designed for optimum redundancy and robustness. Take-off and landing and flight controls will need to address hazardous states and edge cases, with focus on the heightened risk in aerial vehicles.

It will be many years before an autonomous air taxi system enters commercial operation. In Uber’s October 27, 2016 white paper titled “Fast-Forwarding to a Future of On-Demand Urban Air Transportation,” the company acknowledges the “serious potential” but also the need to move stakeholders to address the “political, policy, infrastructural, and socio-economic issues” that surround autonomous VTOL flight.

Recent developments such as those unveiled at CES clearly show that stakeholders are mobilizing. Autonomous air transport is in our future. ■



A self-described “recovering engineer” with 15 years of experience in automotive design and quality, Jennifer Dukarski is a Shareholder at Butzel Long, where she focuses her legal practice at the intersection of technology and communications, with an emphasis on emerging and disruptive issues that include cybersecurity and privacy, infotainment, vehicle safety and connected and autonomous vehicles.