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Smart Cars and Trucks: Spectrum Use for Vehicle Safety

Background

Increasing the autonomy of cars and trucks is seen as an effective way to reduce the 94% of vehicle-related accidents that are caused by human error. While some semiautonomous safety technologies, such as automatic braking and adaptive cruise control, are in use today, autonomous safety technologies under development would require cars and trucks to communicate with each other (vehicle-to-vehicle, or V2V) and with their surroundings (vehicle-to-infrastructure, or V2I). V2V communication is expected to reduce the number of accidents by improving detection of oncoming vehicles and providing driver warnings. V2I communication is expected to help highway operators monitor and manage traffic and provide drivers with information such as weather and traffic conditions. These technologies are part of a congressional mandate to invest in and advance a broader set of intelligent transportation systems to improve traffic flow and safety.

For vehicles to communicate wirelessly, they need access to radio waves, or radio frequencies. In the United States, the Federal Communications Commission (FCC) manages commercial use of the radio frequency spectrum, and allocates spectrum for specific uses. In 1999, the FCC allocated the 5.9 gigahertz (GHz) band to Dedicated Short-Range Communications (DSRC) uses. DSRC technologies, installed in cars and trucks and on roadways, enable V2V and V2I communications.

Integrating DSRC technologies in vehicles and on roadways is in its early stages. Meanwhile, the proliferation of cell phones and other devices has increased demand for spectrum, and a competing technology, Cellular Vehicle-to-Everything (C-V2X), has emerged as an alternative to DSRC for vehicular communications.

In May 2019, the FCC announced it would consider whether the 5.9 GHz band should (1) remain dedicated to DSRC technologies, (2) be allocated to C-V2X, (3) be allocated to automotive communications technologies generally, or (4) be shared with wireless devices. The FCC's decision has important competitive implications for the automotive, electronics, and telecommunications industries, and may affect the availability of safety technologies and the path toward vehicle automation.

DSRC

In 1998, the Transportation Equity Act for the 21st Century (TEA-21; P.L. 105-178) directed the FCC, in consultation with the U.S. Department of Transportation (DOT), to consider spectrum needs for transportation, including the DSRC wireless standard. The goal of the initiative was to leverage technologies to improve traffic flow and safety.

From FY2003 through FY2014, DOT provided about $570 million for research, development, and testing of DSRC technologies. In 2015, it awarded $43 million to three pilot sites (with an additional $9 million in local matches):

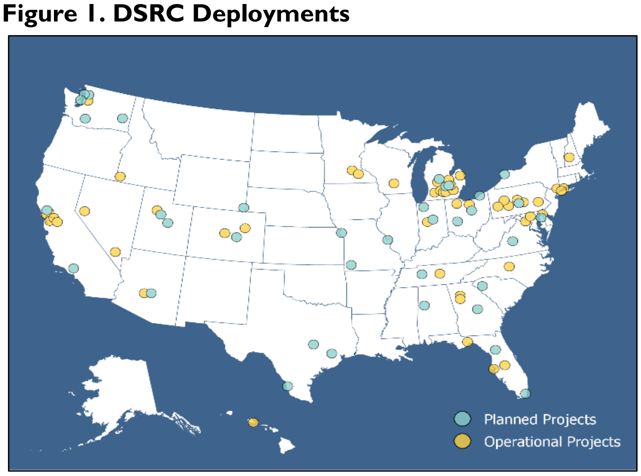
- **Safety in a large metropolitan area.** The New York City Department of Transportation is outfitting 8,000 taxis, buses, and sanitation vehicles with DSRC safety devices to demonstrate connected-vehicle capabilities focused on alerting drivers to potential crashes and reducing accidents with pedestrians.

- **Interstate routes and commercial vehicles.** During severe winter weather along I-80 in Wyoming, DSRC technologies are used to notify cars and trucks of disabled vehicles. Vehicles rebroadcast the warning. The goal is to prevent weather-related crashes.

- **Mid-sized urban area.** Cars, buses, and pedestrians are part of a DSRC pilot in downtown Tampa, FL, that alerts drivers to reduce speeds when approaching heavy traffic, when forward collisions may be imminent, and where intersections are unsafe.

In addition to these pilot projects, several manufacturers in the United States and Europe have begun integrating DSRC technologies into cars and trucks; truck platooning (the linking of multiple trucks into a convoy through V2V communications) has been demonstrated on U.S. highways; and additional DSRC deployments are under way in more than two dozen states (see **Figure 1**.)

Figure 1. DSRC Deployments



Source: CRS, based on data from Volpe National Transportation Systems Center (DOT), May 2019.

Notes: DOT has 52 operational projects and 35 more planned, including more than 26,000 devices deployed on vehicles in urban, rural, and suburban settings.

C-V2X

In addition to research on DSRC, some automakers and telecommunications and technology companies continue to explore other vehicle connectivity options. The 3rd Generation Partnership Project, a standards organization for global wireless networking, created the C-V2X standard in 2017. Like DSRC, C-V2X can operate independently from the cellular network for V2V and V2I communications. C-V2X can also connect to cellular networks and is expected to be able to use future 5G networks. 5G, when fully deployed, is expected to provide high-speed, low latency (i.e., reduced lag time) services needed for autonomous vehicles, allowing information between vehicles and infrastructure to be shared almost instantaneously.

The 5G Automotive Association (5GAA), a consortium of automakers, technology companies, telecommunication providers, standards bodies, and others, supports C-V2X. The 5GAA asserts that C-V2X performs better than DSRC in testing and is emerging as the global standard. In November 2018, 5GAA asked the FCC for a portion of the 5.9GHz band to develop and deploy C-V2X.

Testing of C-V2X has so far been limited. DOT plans to begin tests in three states in summer 2019.

Proposed DOT Standard

At the end of the Obama Administration in January 2017, the National Highway Traffic Safety Administration (NHTSA) proposed a new federal safety standard that would require all new light vehicles—passenger cars, sport-utility vehicles, and pickup trucks—to be equipped with DSRC technology by 2023. Proponents say that this mandate is necessary to ensure compatibility and connectivity across all vehicles and systems; DOT projected that implementing it could prevent more than 1,000 fatalities annually. The Trump Administration has taken no further action on this proposal; it has stated that DOT should remain technology-neutral rather than mandate a specific technology. It encourages the development of multiple technologies that utilize the 5.9 GHz band for transportation safety.

Policy Considerations

In 2012, Congress directed the FCC to determine whether the 5.9 GHz band could be shared to support unlicensed devices such as cordless phones, wireless speakers, and Wi-Fi devices (P.L. 112-96, Title VI). The FCC is conducting extensive testing to determine whether these devices would cause interference with DSRC technologies.

In May 2019, FCC Chairman Ajit Pai called for reexamination of the 5.9 GHz band. Several FCC commissioners have supported this move, noting that the pace of deployment of DSRC technologies left spectrum underutilized while consumer demands for spectrum are increasing, and that new technologies surpassing DSRC's capabilities need access to spectrum to develop.

Motor vehicle, telecommunications, and technology firms have both competing and overlapping interests in the outcome. Some automakers have invested in DSRC and have plans to include it in their fleets: Cadillac markets a model now that includes it. Ford, Volkswagen, and Toyota planned to follow suit, but have paused deployment due to the lack of a federal standard and spectrum uncertainties, and also see benefits in C-V2X. Telecommunications providers stand to benefit from C-V2X, as it relies in part on cellular networks and has the potential to increase their customer base and revenues. Telecommunications technology companies, such as Qualcomm, which makes both DSRC and C-V2X chips, stand to benefit from an expanded connected car market.

DSRC advocates, such as the Safety Spectrum Coalition, which includes the Association of Global Automakers and the American Trucking Associations as well as many state departments of transportation, argue that millions of dollars have been invested in DSRC and that the technology has been thoroughly tested and is currently being deployed. They argue that 5G deployment is years away in many areas, so the benefits of C-V2X will take years to arrive.

Both DSRC advocates and 5GAA agree that the 5.9 GHz band should remain dedicated to vehicle safety and other intelligent transportation uses and should not be made available for other purposes.

While the issue may be framed as a choice between DSRC and C-V2X, these two technologies could coexist. The Colorado Department of Transportation states that its intelligent transportation system, RoadX, can accept and transmit V2V and V2I information on both DSRC and cellular platforms; in time, vehicles and roadside infrastructure may be able to communicate under both standards.

The Coalition for Safety Sooner—comprising 15 state DOTs and other state highway authorities—says it is not in the public interest to delay the deployment of currently available safety technologies while waiting for other technologies to emerge. On the other hand, the Wi-Fi Alliance, whose members include major electronics companies such as Apple, Cisco, and others, along with consumer groups and wireless internet service providers, is urging the FCC to complete the interference testing before adding new users to the band. These groups argue that sharing the band with unlicensed devices, including Wi-Fi devices, will expand public access to broadband.

The challenge for policymakers is balancing the interests of multiple stakeholders: investors in DSRC who committed funding to develop car and truck safety technologies and other intelligent transportation systems; consumer safety advocates and others who want currently available technologies to be diffused quickly; potential users of expanded Wi-Fi services; C-V2X advocates who are eager to deploy the next generation of vehicle safety technologies; and the nation at large, which could benefit from expanded deployment of technologies that would improve vehicle safety, make roadways more efficient, and provide the economic gains that often accompany the development of new technologies.

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