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Advanced Radar to Challenge Lidar in Autonomous-Vehicle Sector

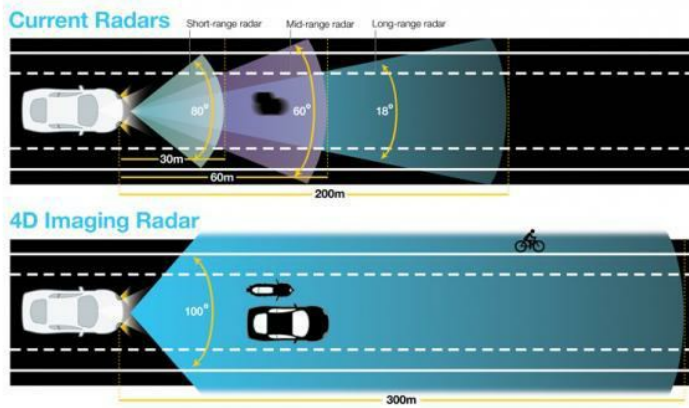
David E. Zoia | *WardsAuto*

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Tel Aviv-based Arbe Robotics says its new four-dimensional high-resolution imaging radar, ready for testing later this year, outperforms lidar and will be available for a fraction of the current cost.



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NOVI, MI – Automakers are scrambling to line up lidar suppliers – in some cases through acquisitions – as they march toward Level 3 autonomy and beyond.

But an Israeli developer says it is nearly ready with new radar technology that could lessen the need for lidar – or eliminate it altogether.

Conventional wisdom is Level 3 and above autonomous vehicles will need a triumvirate of sensors, including radar,

camera and lidar systems to detect objects around a vehicle with full certainty and provide the accurate data needed to determine a swift and safe path forward.

Volvo is the latest to strike a deal to secure lidar technology for the future, with an undisclosed investment in Silicon Valley startup Luminar announced last week. But the Swedish automaker isn't alone in trying to stake out ground in lidar. Toyota has invested in Luminar, General Motors acquired upstart developer Strobe in 2017 and Ford has put money into Velodyne, a lidar-technology leader.

Even though cost is coming down and packaging improving, lidar remains the most expensive of the three sensor types, making it one of the potentially biggest stumbling blocks to bringing automated driving technology to the mass market.

A single lidar unit can range from \$3,500 to \$24,000 or more, depending on size and capability. Estimates put the cost of equipping an autonomous car with lidar as high as \$75,000 today, but some industry insiders project that will fall to about \$1,000 per vehicle as the market begins to emerge in the early 2020s.

However, Tel Aviv-based Arbe Robotics says its new four-dimensional high-resolution imaging radar, ready for testing later this year, outperforms lidar, particularly in inclement weather, and will be available for a fraction of the current cost.

Like many Israeli technology companies moving into the autonomous-vehicle sector, Arbe comes to automotive from the defense industry, where it has produced radar for drones.

That technology is being transitioned for automobile application in the form of Ultres, Arbe's automotive-grade radar that is about the size of a car audio speaker and capable of



Ultres radar unit.

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providing 4D imagery of objects (three-dimensional imagery, plus speed) more than 1,300 ft. (400 m) away.

Unlike conventional radar that simply tracks targets, Ultres provides a picture of the entire surrounding area, Arbe Robotics CEO Kobi Marenko says. He predicts autonomous vehicles will not be able to reach the required safety performance levels without such 4D imaging radar.

In a demonstration drive around the parking lot of the Suburban Collection Showplace outside the TU Automotive Detroit conference and exhibition here, Ultres is able to detect objects in motion – even the arm movements of a person in its path. Although the demo features only azimuth field of view (indicating the position of objects in relation to the vehicle), the Arbe radar also can provide the elevation view the industry is beginning to demand that shows the height of objects in its path.

Resolution depends on the size of the unit, says Bill Latino, vice president-Sales and Business Development, but a 6.6-in. (17-cm) square Ultres module can detect objects with just 0.7 degrees of separation, about equivalent to top-end lidar. The unit can detect 450,000 objects per frame and draws just 15W-20W of power.

“The only limitation we have with the resolution is the size of the radar, the size of the aperture,” Latino says, noting the 3.5 in. by 5.4 in. (9 cm by 13.8 cm) unit more likely to fit neatly into cars still would approach a 1-degree angle of resolution. “We’re being limited by the car manufacturers, the aesthetics of the car on the kind of resolution we can achieve,” he notes.

The Arbe unit, which has a 100-degree field of view, is somewhat bigger than the most advanced solid-state radars now emerging. Velodyne’s most compact lidar measures 2.0 ins. by 4.9 ins. (5 by 12.5 cm) and has a field of view of 120 degrees, for example.

But the Ultres radar has other advantages over lidar, Latino says. Its range more than doubles today’s lidar capability, which typically can extend to 490-660 ft. (150-200 m). Cost is said to be substantially less than lidar, as well.

“This module at inception is going to go for the cost of adaptive cruise control today,” Latino says, adding it would take about five Ultres to provide 360-degree coverage for a Level 4 autonomous application. In January, Aptiv demonstrated an autonomous vehicle with 10 radars, nine lidars and two cameras.

Marenko says the Ultres radar can achieve Level 3 and above autonomy “without the need for more than one lidar unit per vehicle for redundancy, or possibly no lidar at all.”

Because of its low cost, the technology isn’t seen solely as a replacement for lidar; it also has nearer-term potential to nudge out existing radar systems already in use.

“Ultres will handle Level 4 and 5 (autonomous-vehicle) requirements, but we can easily put this in a Level 2, Level 3 (application),” Latino says. “So we’re talking to customers today about current requirements, not just 2025 targets.”

The industry’s reaction to the new technology has been positive, Latino says. “Tier 1s say, ‘This looks great, but we have our own radar.’ Then we go to the OEMs and they say, ‘We’re going to go talk to that Tier 1 because we want them to look at your technology.’”

The device will be available for testing by the end of the year and could be available for production as early as ’20-model vehicles, although for now the initial application is for an advanced Level 2 automated-driving system (what some are calling Level 2-plus) on a Chinese vehicle in ’21-’22.

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