LIDAR Companies: Whether to be a Cheetah or a Hyena

The message from the OIDA Forum on Optics in Autonomy was that the schedule for self-driving cars is taking longer than expected. That's not a surprise, but the investors are catching on. In the words of Alexei Andreev of Autotech Ventures, each LIDAR supplier needs to consider whether it wants to be a "cheetah" or a "hyena." East African cheetahs prefer large but fast-moving Thomson gazelles, while hyenas are known for scavenging whatever they find. Likewise, the self-driving car market is a large but hard-to-catch prize, while smaller opportunities may be more suited for many LIDAR companies today.

The U.S. market is the most open to innovation in this segment, led by companies like Waymo, but U.S. companies may have aimed too high by targeting Level 5 driverless capability. The global opportunities require a more incremental approach, by adding more and more ADAS (Advanced Driver Assistance Systems) features. This builds trust in automation while suppliers further develop the necessary technologies. (For more detail on the progress at each level of autonomy, see these EE Times articles here and here.)

Until recently, companies were breathlessly claiming that production was coming soon. As we reported in the May OIDA Newsletter, Elon Musk recently claimed that Tesla would be operating a fleet of robotaxis by the end of 2019. But more recently, he was rumored to be unhappy that employees said they can't meet the timelines that Musk set for the technology, and several of the software team are said to have left Tesla (here). He has dismissed the need for LIDAR in autonomous cars, but he may be right about that, insofar as Tesla's near- to mid-term future is concerned. Tesla continues to gather valuable driving data while increasing the level of autonomy. By the time LIDAR is necessary, Tesla may be a very different company. Like an wrecked vehicle, it might be sold off in pieces, including hardware, software, and data.

The self-driving car is a speculative opportunity, but why has the mood suddenly gone from bravado to skepticism? Jin Shang of Guangzhou Automotive Corporation (GAC) said that GAC expects to have Level 3 vehicles in mass production by 2020 or shortly after. But a key issue is the safety of the software, which isn't mature yet. Amir Bar-Niv of Aquantia pointed out that the Boeing 787 can land itself with 14-18 million lines of code, while Level 3 vehicles already have about 50 million lines of code, and 100 million lines of code are expected for Level 4. Even hardware can be so software-intensive that struggling LIDAR companies may be eventually stripped of their hardware and sold for their software expertise.
Anand Joshi of market research firm Tractica expects Level 2.5 or 3 soon, but not Level 3.5 or 4, and reaching Level 5 might never happen. After all, full Level 5 autonomy is probably not necessary to save lives on streets and highways. There are also the matters of insurance (including insurance to protect against computer hacking) and government regulation. Most important is trust, as the entire transportation network relies on trust.

Shang said that LIDAR is still not an auto-grade product, and is too expensive. Where LIDAR is used, the choice of which LIDAR technology to use may vary by the level of autonomy, and what is ready. While everyone agrees that the autonomous systems improve by including LIDAR, LIDAR may not be necessary until Level 4, which may be ten years away.

Short component lifetimes are not a showstopper. Early vehicles will be for robotaxi and other types of fleets, where the use might be 8,000 hours per year, as compared to 8,000 hours of system life for a typical car. Fleet vehicle operators can tolerate greater maintenance costs, including tuning and replacement of technology. But autos are so complex that the failure rates of specific parts may nonetheless need to be in the range of a few FITs (defined as one failure per billion hours), and over the usual wide range of environmental conditions required for the auto industry.

So what are LIDAR suppliers to do? An example of a "hyena" opportunity is autonomous mining equipment (here), aimed at improving safety and alleviate shortages of skilled drivers. Companies have operated this equipment autonomously in the field for several years already. A mining truck costs US$ 5-10 million, so an additional US$ 100K LIDAR subsystem to help make it autonomous can still achieve a return on investment that would be wildly unrealistic even for personal vehicles operated by fleets (such as Uber).
John Dexheimer (in figure), a longtime OIDA member and key planner for the event, has more perspectives [here](#). The event was held on 27 June 2019 in San Jose, California, with help from sponsor [Laser Components](http://www.lasercomponents.com). The event was collocated with Sensors Expo 2019 and the [OSA Optical Sensors and Sensing Congress](http://www.osa.org/industry). OIDA members can access the presentations [here](#).

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