

From: Cindy Winter
To: [Denise Merleno](#)
Subject: Comments re AV's for the Board meeting January 25
Date: Wednesday, January 24, 2018 6:15:13 PM

Denise,

Unfortunately I cannot attend the Board meeting, due to a Larkspur planning session that must take precedence. But if I could be there with you all, here's what I would say.

On February 9th, at the first Executive Committee meeting, I'll talk about all that's new in ride-share.

Best regards,
Cindy

**TAM Board Meeting
January 25, 2018**

Autonomous vehicles: Neuromorphic chips and lidar

A year ago, a really smart Ph.D. would sit in a cubicle for six months and using the if-then formula, would hand-code a detector that spotted objects on a road. The code would then be incorporated into a do-it-all central processing unit.

Now, thanks to the new neural networks, within 24 hours not a human but instead vast amounts of software data can teach tiny specialized chips what they should do in various situations. For AV's, one chip might focus on a red circular lights, recognize that they mean "come to a stop", and then look for the appropriate place to do so. Another chip might apply the brakes. By separating the various functions into discrete challenges, and then communicating them to a central processing unit, the creation of AV software can proceed with amazing rapidity. Some of you may recall that I reported on this change last September.

Until last Monday, the communication among the specialized chips had been relying on the familiar assumption of binary on-or-off signals. But this is not how a human brain operates. The goal has long been the creation of a "neuromorphic" chip, with artificial synapses that mimic how different brain neurons fire off at different strengths to one another.

On Monday, MIT announced that it had achieved just that. The combination of artificial neural networks and neuromorphic chips could let A.I. systems be packed into smaller devices

and run a lot more efficiently – meaning widespread AV use grows ever closer.

Earlier this month, at the 2018 Consumer Electronics Show in Las Vegas, a great many robotic taxi vehicles roamed the jammed streets with no untoward events reported.

The consensus from CES is that AV's are approaching the stage where, in another year or so, they'll be used by commercial services in well-mapped, limited areas of big cities. Already, this year, Waymo will start a driverless taxi service in Phoenix, which has a reliable rectangular grid of wide streets and good weather.

However, the prediction at CES was that very few individuals will own a self-driving car in the near future. A major reason is cost, which taxi's, ride-share, and truck fleets can pass on to end users, but which at present are too onerous for most consumers to bear.

A major unresolved cost is LiDAR, an essential sensor. The acronym stands for “Light, Distance and Ranging”. Its spinning, multi-beam lasers generate highly detailed 3-D images containing accurate depth perception. (Radar, however, is what sees through bad weather.)

Even though San Jose's Velodyne reduced the price for its top-quality 360-degree LiDAR from \$8,000 to \$4,000 the first week of this month, car-makers say they want LiDARs to cost \$100. At present that seems a pipe dream. While Velodyne and its competitors are beginning to produce cheaper solid-state devices, an AV will require four or more of these (to obtain the required 360 degrees) and I've read that each will cost close to \$1,000, so where does that get you?

Yet I have no doubt that LiDAR and other technical challenges will be worked out, and probably sooner than we might anticipate. Frenzied worldwide competition among firms large, mid-size, and small increases by the day. Top engineers move from one firm to another, or establish their own new one, expecting to sell it in a few years for multiple millions. Partnerships form and un-form. Promising start-ups leap out of stealth mode. It's all one enormous creative chaos of people and ideas, a ferment where technical problems are being identified and resolved at an amazing speed.

When two years ago, in January 2016, TAM began thinking about AV's, the concept seemed a distant dream, at least it did for me. And yet, here they are, test driving in San Francisco and no doubt coming soon to Marin.

Respectfully submitted,

Cindy Winter