Emergency Braking Sensor Market Heats Up

Mobileye’s Competitors Offer Alternatives

To get the coveted five-star Euro NCAP rating on their new vehicles, carmakers have been installing automatic emergency braking (AEB) features since 2014. To get a 5-star rating in 2016, cars will also have to brake automatically for pedestrians. That new requirement further invigorated the market for forward-looking camera sensors, which are used widely to identify and track pedestrians who may be in harm’s way and signal when braking is required. The market for AEB sensors received yet another boost from a decision made by ten carmakers operating in the U.S. who agreed this past September to voluntarily make AEB technology standard on all their new vehicles, although when each carmaker will make that happen wasn’t made clear. In January 2015, NHTSA announced its proposal to add AEB to the list of recommended advanced safety features included in the U.S. NCAP program.

The worldwide installation rate for automatic emergency braking systems will increase from approximately 5% in 2015 to approximately 18% by 2020, according to market researchers at IHS. The 2020 installation rate projection could climb once IHS completes its analysis of the September announcement. AEB systems will be largely based on forward-looking camera and radar sensors.

In any conversation about AEB sensors, the subject inevitably turns to Mobileye, which has a near monopoly in the market for image processing software and the chips that process the software. Years ahead of every competitor, Mobileye technology first found application in production vehicles in 2007, on four Volvo models. Working with Delphi as the integrator of Mobileye’s EyeQ image processor, Volvo introduced Collision Warning with Auto Brake, using radar and camera fusion. Mobileye claims it has won 80% of the RFQs it has responded to over a six-year period prior to its IPO in 2014 and 100% since the IPO.

Turn to AEB Competition, page 3

Autosar’s Next Generation: The Adaptive Platform

As the industry answers the many challenges of automated driving and vehicle connectivity, software complexity will only increase. Rather than adding another version to the existing Autosar software standard, the Autosar partnership has decided to create a brand new standard, which it calls the Adaptive Platform.

Simon Fürst, Autosar spokesperson and general manager for software development and software infrastructure at BMW, explained the thinking behind the new Autosar product: “Autosar is already quite complex with many configuration options and potential use cases. If we tried to support the next big step in functionality with the existing platform it would get even more complex. It is not possible to have a single platform that is suitable for everything from 16-bit controllers up to high-performance multicore 32-bit controllers.”

The existing platform will be referred to as Classic Autosar. Compared with the Adaptive Platform, Classic Autosar is static, a monolithic software block. The Adaptive Platform is dynamic, meaning you can load and unload software during runtime.

“This is the fundamental difference,” said Mr. Fürst. “Similar to Android or iOS in the smartphone, this dynamic behavior requires some additional resources. It was not possible to make this a feature within our existing release 4.x technology. In the future, carmakers will be using high-end multicore microcontrollers even supporting

Turn to Autosar Adaptive Platform, page 2

Interview with Ford’s Jim Buczkowski

I spoke this month with Jim Buczkowski, director of electrical and electronics systems research and advanced engineering at Ford, about automotive electronics trends, standards, and Ford’s needs and challenges. A Henry Ford Technical Fellow with 35 years of service to Ford, Mr. Buczkowski has led or participated in numerous automotive electronics innovations at Ford, including Ford’s Common Global Electrical Architecture and, early in his career, Ford’s first 16- and 32-bit powertrain controller designs. He has long been and still is the face of electronics at Ford.

In consideration of his long history at Ford, I asked Mr. Buczkowski which new electronics features at Ford make him most proud. The first generation of Sync was his immediate answer. Released to the market in 2007, the Sync communications and entertainment system lets drivers make hands-free phone calls and control music and other functions by voice. Rather than relying on an embedded modem, Sync makes use of the driver’s brought-in device. “Sync is significant because it made telematics affordable, what we refer to as the democratization of technology,” said Mr. Buczkowski. “We did this with other features as well, for example, forward collision warning and blind-spot detection.”

Challenges

Open Source Software

The consumer electronics industry often leverages open source software as a way to speed new products to market. Mr. Buczkowski sees open source software as a huge opportunity for carmakers to build on what others have already developed to make software that is as close to defect-free as possible. “I am very positive about open source but our challenge is how to use it effectively and answer the many legal questions that come with it. We will figure it out.”

Turn to Buczkowski, page 8
memory management units similar to what we see in smartphones today. They will consume and process data streams with much higher data rates than you have today in cars.”

The first release of Adaptive Platform software is set for the first or second quarter of 2017. An Autosar study group was formed in 2013 to identify future platform demands and begin collecting the initial use cases. The Autosar partnership made the decision to develop the Adaptive Platform earlier this year. On December 9, 2015, the Autosar Executive Board will meet at Daimler headquarters in Stuttgart. There it will make a final decision about the Adaptive Platform’s capabilities and what the work schedule will look like over the coming months. Executive Board members are BMW, Bosch, Continental, Daimler, Ford, GM, PSA Peugeot Citroën, Toyota and Volkswagen.

A reference implementation of the Adaptive Platform will be created within the Autosar partnership. This approach differs fundamentally from the way Classic Autosar was developed, which was to focus on the specifications and then wait for software implementations from suppliers. “This validation implementation of the Adaptive Platform is what we want to license to the Autosar partners,” said Mr. Fürst. “We expect this shortened feedback loop to speed up the whole process of making the software system mature. It is similar to the approach taken by Genivi.” The platform’s development will be an open source project (open to Autosar members) to which Autosar members will be asked to contribute.

Another significant change from Classic Autosar is that the newly designed architecture will not be an automotive-only solution. The partnership intends to apply appropriate solutions from other domains. Autosar intends to make POSIX (portable operating system interface) part of the platform. “This [standard] will ensure that an appropriate Linux or some other commercial operating system can be used. The key message is that Autosar will not specify the operating system,” Mr. Fürst noted.

Ethernet will be the platform’s number-one bus system. POSIX operating systems provide support for Ethernet. Backward compatibility to CAN, FlexRay and LIN will also be part of the platform.◆

Penetration of Classic Autosar Not Nearly Complete

Next month will mark 12 years since the founding of the Autosar partnership, which created a standard platform so software solutions could be reused and shared among carmakers, vehicle platforms and supplier solutions, providing the industry with the potential for tremendous cost savings. The partnership’s 211 members include all the world’s major carmakers and tier-ones, and almost every automotive semiconductor supplier.

After speaking with top executives from four of the world’s major suppliers of Autosar tools and software, Vector, KPIT, ArcCore, and Mentor Graphics, we have the strong impression that Autosar penetration around the world still has a long way to go. The good news is the market for Autosar tools, software and engineering services is growing at a double-digit rate. “We see approximately one major carmaker each year makes the jump into a systems engineering approach to Autosar, and that brings along their supplier base,” said Henrik Olsen, marketing manager for in-vehicle networking products at Mentor Graphics.

Enthusiasm for Autosar varies from carmaker to carmaker. The Europeans, with the exception of Fiat and PSA, are making Autosar a requirement. BMW and Volvo have been the most aggressive. In the States, while GM has made more positive moves than Chrysler or Ford, it doesn’t appear that GM will make a rapid transition to Autosar. Among the Japanese carmakers, Nissan seems more ambitious about the standard, given its links to Renault, than does Toyota or Honda. However, Hyundai does appear to be on a path toward making Autosar a requirement.

Ford’s advanced E/E director, Jim Buczkowski, agrees with the goals and vision of the Autosar partnership, but while some Autosar network or other components are aboard some Ford vehicles, the carmaker hasn’t come to the conclusion that it will require a complete Autosar stack. “If Autosar is really creating efficiencies we ought to be able to see that reflected in the quotes we get from suppliers,” he said. That hasn’t been the case thus far.◆
AEB Competition...

Continued from page 1

Mobileye Overvalued

To investors and analysts hyping Mobileye stock, autonomous driving is the future, and Mobileye with its dominant position in the image processing market must hold the keys to that future. In early October 2015, Mobileye’s market capitalization stood at $10.35 billion, an astronomical 49 times sales. Its price to earnings ratio was 714, compared with the NYSE Composite Index average P/E of 20.5.

According to the crowd-sourced financial content service, Seeking Alpha, Andrew Left’s Citron Research seeks to expose companies whose management is in some way misleading investors. When discovering such situations, he usually shorts the stocks he writes about. Here from a September 24, 2015, report are some of Citron Research’s conclusions about Mobileye:

No semiconductor company in history has ever maintained margins and market share that the analysts have conferred on Mobileye. ... You have to buy the notion that they can maintain this powerful control of their market niche not just for years, but for decades, as a supplier to one of the most cost-sensitive and price-cut-throat businesses in the world: the automotive business.

To make it crazier, you must go to sleep knowing that Mobileye is going to be able to maintain this advantage while spending a drastically lower percentage of their revenue on research and development than Microsoft, Apple, Google, Facebook, Qualcomm or Intel.

All while knowing that insiders have been selling their stock at an unprecedented pace—85% of the $1.8 billion raised from its two stock sales have been to enrich insiders, not to build company coffers for the battles ahead.

The equation right now is their database. Our objective is to be able to interpret the data as data without comparing it against some database. I think we will give them a run for their money.”

Though, according to email correspondence with Mobileye spokesperson Yonah Lloyd, “[Mobileye] has” more than 20 mil-
The Company Profile...  Panasonic

**Headquarters:** Osaka, Japan  
**FY 2015 Sales:** ¥7,715.0 billion ($64.2 billion)  
**R&D Expenditures:** 5.9% of sales  
**Interest Expense:** 0.2% of sales  
**Capital Investment:** 2.9% of sales  
**Net Margin:** 2.5%  
**Operating Margin:** 5.0%  
**Employees:** 245,084 as of March 31, 2015  
**Sales per Employee:** ¥31,479 million ($262,107)  
**Working Capital:** ¥728 billion* ($6.1 billion)  
**Long-Term Debt:** ¥711 billion* ($5.9 billion)  
**Total FY 2015 Sales:** ¥7,715.0 billion

**FY 2015 Automotive Sales:** ¥1,204 billion ($10.0 billion)  
**Capital Investment:** 5.2%  
**Main Automotive Products:** Infotainment systems and batteries  

*As of June 31, 2015  
**FY 2015 ended on March 31, 2015.**

**Background**

The company was founded by Konosuke Matsushita in 1918 and was incorporated as Matsushita Electric Industrial Co. in 1935, in Osaka. The business expanded into multiple global markets including communications, electronics, appliances, avionics, consumer electronics, batteries, automotive navigation and entertainment systems and more. Adopting the name of its widely known brand, the company officially became Panasonic Corporation in 2008.

In 2009, Panasonic acquired a 50.2% stake in Sanyo, for ¥400 billion, making Sanyo a subsidiary of Panasonic. In July 2010, Panasonic announced that it would acquire the remaining shares of Sanyo and did so by the end of 2010, significantly improving its position in the automotive battery market.

After the global economic downturn in 2008, the tragic Japan earthquake and tsunami in 2011, and facing increasing competition in televisions and other consumer goods, Panasonic in FY 2012 posted a record loss of ¥772 billion (9.8% net margin) and initiated a major restructuring. In the process it exited non-profitable businesses in consumer markets, reduced its headcount, closed some facilities and paid down debt. In February 2015, Moody’s raised Panasonic’s debt rating to Baa1, (medium grade, moderate credit risk) recognizing its steady and improving profitability.

The Automotive and Industrial Systems Company (AIS) was established in 2013, one of Panasonic’s five business segments. “[Automotive] is the growth driver of AIS Company growth through FY 2019,” according to Yoshio Ito, AIS president. Panasonic has been investing aggressively in its automotive business, some ¥60 billion ($500 million) in FY 2015. The company will make ¥100 billion in capital investments in FY 2016 on behalf of its automotive business. Most of those funds will be used to construct the lithium ion battery Gigafactory in partnership with Tesla.

**Acquired 49% of Ficosa**

In September 2014, Panasonic directed part of its automotive investment toward a capital and business alliance with Ficosa International, a broad-line, tier-one automotive parts supplier headquartered in Barcelona, Spain. In 2013, Ficosa produced €925 million ($1.1 billion) in sales with 8,661 employees at year end. While some of Ficosa’s products (door and seat systems, underhood fluid and vent systems, shifters and parking brakes) have little electronics content, Panasonic was drawn to Ficosa’s rear- and side-view mirror business as well as its antenna and communications (eCall) module businesses. Together the partners will develop electronic mirrors, which replace or complement mirrors with a camera and monitor, and vehicle connectivity solutions.
Panasonic

Panasonic Automotive Sales and Targets by Fiscal Year

<table>
<thead>
<tr>
<th>Year</th>
<th>In ¥ trillions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>.612</td>
</tr>
<tr>
<td>2012</td>
<td>.653</td>
</tr>
<tr>
<td>2013</td>
<td>1.0</td>
</tr>
<tr>
<td>2014</td>
<td>1.18</td>
</tr>
<tr>
<td>2015</td>
<td>1.21</td>
</tr>
<tr>
<td>2016</td>
<td>1.30</td>
</tr>
<tr>
<td>2017</td>
<td>2.10</td>
</tr>
<tr>
<td>2018</td>
<td>2.50</td>
</tr>
</tbody>
</table>

The jump in automotive sales from fiscal 2012 to 2013 was due to big increases in three product lines: navigation, displays and cameras, according to Panasonic.

Roughly 10% of the 2019 sales target is expected to come from collaborations, mergers and acquisitions.

The 2021 target is a personal goal of Yoshio Ito, Automotive & Industrial Systems Company president.

Panasonic is exploring other partnerships or acquisitions, especially in the area of safety and advanced driver assistance systems.

Automotive Business

Regionally, Panasonic’s automotive business is focused on Japan, Europe, the United States and China. In 2014, AIS opened an office in China to drive and expand local business. Panasonic Automotive Systems Company of America (PASA) acts as the North American operating company of AIS. PASA is headquartered in Peachtree City, Georgia, with sales, marketing and engineering operations in Farmington Hills, Michigan.

Among its strengths with automotive customers, Panasonic points to its ability to leverage decades of experience in consumer electronics including wireless communications and audiovisual technology. Panasonic is a major supplier of mobile phones, TVs, batteries and digital cameras.

“We have a tremendous amount of development resources and a wide selection of technologies that can be applied to the many automotive challenges, from the human-machine interface, to driver assistance systems, to infotainment, and battery and power-supply systems,” asserted Allen Kudla, senior vice president of Panasonic Automotive Systems Company. “The world’s major carmakers trust us to deliver innovations on time and with quality. We are particularly good at software and hardware integration.”

Panasonic’s automotive products are grouped into three business divisions: Infotainment, Electronics and Batteries.

Automotive Distinctions Claimed by Panasonic

- World’s number-one camera supplier (based largely on its rear-view camera sales)
- World’s number-one supplier of infotainment systems
- World’s number-one supplier of batteries for plug-in vehicles
- AUPEO! is the only in-app interface available on consumer phones that is endorsed by Connected Car Consortium

Automotive Sales Set to Accelerate

From FY 2013 to FY 2015, Panasonic’s automotive business grew at 9.4% per year, which is somewhat faster than the market. Even from that healthy pace the plan calls for automotive sales to further accelerate. From FY 2016 to FY 2019, the plan calls for a 17.3% annual growth rate. Impressively, as of May 2015, Panasonic had already booked 70% of its ¥2,100 billion sales target for FY 2019.

The components of that plan are detailed below for each of Panasonic’s major product segments: Comfort (including infotainment), Safety (including ADAS) and Environment (including lithium ion batteries).

- Comfort Systems

  The plan calls for 15.7% annual growth from FY 2016 through FY 2019 in the comfort systems segment, with FY 2019 sales reaching ¥930 billion. Well over half of the segment sales will come from new products, according to the company.

Head-Up Displays

Panasonic is relatively new to head-up displays. In 2013, it introduced a head-up display that sold in the Japanese aftermarket for ¥60,000. The dash-mounted unit (projector and combiner) was also marketed to OEMs. At the 2014 North American Auto Show, Panasonic showcased a head-up display that could be built into the instrument panel and project onto the windshield. Panasonic’s windshield HUD, targeted for model year 2016 vehicles, features proprietary circuit board packaging that significantly shrinks the size of the heat sink, which allows a 40% reduction in size compared with competitive products.

“Another key is our free-flow mirror technology where we are able to form a very specialized mirror under very tight tolerances,” said Scott Kirchner, executive vice president and chief technical officer for PASA. “That allows us to project a large display onto the windshield from a closer range. As a result our HUD can be more easily integrated into the instrument panel.”

Panasonic has won some HUD business, and the HUD market is growing. By 2020, 7% of new vehicles will have HUDs compared with about 2.5% penetration in 2015, according to Strategy Analytics.

eCockpit

With the advent of powerful multicore processors and affordable, reconfigurable displays, infotainment suppliers and cluster suppliers see opportunities to supply all the driver interface electronics: infotainment, clusters and head-up displays. Already the world’s number-one infotainment system supplier, Panasonic intends to also be the world’s number-one integrated cockpit electronics supplier, by FY 2019.

“We with eCockpit we want to create an integrated user experience, one that is safe

Continued on page 6
Panasonic

and intuitive,” said Mr. Kirchner. “We want to create a similar look and feel no matter which screen the driver is looking at.” The challenge is to make systems that don’t distract and are cognitively undermining. Panasonic plans to make monitoring the driver for drowsiness, head position and gaze all part of its future integrated eCockpits.

This fall, Panasonic began mass producing flexible touch panels for carmakers at a factory in China’s Shandong Province. Panasonic aims to double sales of automotive touch panels from fiscal 2014 levels to more than ¥20 billion in fiscal 2019.

Infotainment

The world’s number-one supplier of infotainment systems, Panasonic claims to have the largest customer base of any infotainment supplier. Customers include FCA, Ford, GM, Honda, Mazda, Nissan, Subaru, Tesla, Toyota and VW.

“As a result we have a huge advantage of being able to work with all the main software platforms—QNX, Android or Linux—and with microcontroller chip sets from Nvidia, Intel, Qualcomm and Texas Instruments,” said Mr. Kirchner. “We draw from Panasonic’s consumer electronics businesses. Panasonic uses Android in its phones. Our TVs and BluRay players use Linux, and we already have quite a lot of automotive experience with QNX. ... Our ability to tailor a solution from software pieces we already have on the shelf is one of our strengths.”

Panasonic produces the Chevy MyLink, Buick Intellilink and Chrysler UConnect. Currently Panasonic and Ford are launching Ford’s Sync 3 infotainment systems, all of which are based on the QNX Car software platform.

While some infotainment suppliers have been reluctant to take on high-end infotainment system development because the massive amount of nonrecurring engineering required can be difficult to budget, Panasonic has no such reluctance. “As a company with a strong global footprint, we usually strategize a way to get it done,” said Mr. Kirchner.

“Panasonic can leverage a large and diverse global development footprint. We have resources in India, China, West Europe, East Europe, the U.S. and Canada. We have Panasonic Automotive India, but we can also utilize the traditional off-shore development companies like Wipro, Tata Elxsi, iGate or Jasmine, a company that specializes in tuner work. We tend to go where we can find the best experience and track record.”

Ford Sync 3

Ford developed Sync 1 and Sync 2 without a traditional tier-one infotainment supplier but decided to work with Panasonic for Sync 3. Panasonic was already a supplier well known to Ford for its audio products. Sanyo, acquired by Panasonic, had also been a longtime Ford partner.

According to Jim Buczkowski, director of electrical and electronics research and advanced engineering at Ford, Panasonic’s experience as the developer of Chrysler’s UConnect infotainment system suggested it could handle Sync 3. “And in the process of technical review as well as commercial review, Panasonic won the business,” he said.

According to Mr. Kirchner, “Panasonic is the design-responsible engineering house for Sync 3, meaning the hardware design, the software design and the electronics. Architecturally Sync 3 is similar to Sync 2, but there is a lot more [computing] power, a lot more memory, more speed and responsiveness, not only because of the electronics but because of the efficiency of our software platform. Of course, QNX is a key partner.”

Panasonic supplies the Sync 3 silver box; the contract manufacturer Flextronics is Ford’s second source. Ford has multiple suppliers for the audio system that is paired with Sync 3; Panasonic supplies THX for Lincoln, as well as Shaker Pro for Mustang. Visteon is the amp supplier for base audio, and Harman supplies the Revel audio system for Lincoln.

Shipments of Sync 3 for Ford’s North American launch began this summer.

AUPEO! Audio Service

In 2013, Panasonic acquired Berlin, Germany-based Aupeo, which provides a delivery platform for personalized audio content such as music, traffic updates and weather reports for Internet-connected devices. At the time it was acquired, Aupeo had partnerships with Mercedes, BMW, Mini and Pioneer for its AUPEO! streaming service, launched in 2008. At the 2015 Consumer Electronics Show, Aupeo launched its Personal Radio by AUPEO! platform, which can learn user preferences and recommend content from different sources. Aupeo is a subsidiary of Panasonic Automotive Systems Company of America.

Safety Systems

Panasonic’s plans call for sales of Safety products to grow from ¥280 billion in FY 2015 to ¥470 billion in FY 2019, a 14.9% annual growth rate. Panasonic intends to strengthen its base of sensing technologies, starting with cameras. The company is especially keen to supply advanced driver assistance components to tier-one suppliers in the U.S. and Europe. It expects its ADAS sales to accelerate after FY 2021.

Cameras

Starting from its position as the world’s number-one supplier of backup camera modules, Panasonic looks to expand its side-view and surround-view camera
Panasonic

business and eventually move into the forward-looking camera market. Forward-looking camera applications are especially hot now as carmakers around the world implement autonomous emergency braking systems for pedestrians, which rely mainly on cameras. Panasonic is developing stereo camera systems and plans to strengthen its image processing and lens technologies for ADAS applications.

“The foundation for our 360-degree-view images and our ability to remove noise, even weather noise from rain and snow, comes from our consumer electronics heritage with television as well as from our professional video camera business,” noted Mr. Kirchner.

Radar

Not only is Panasonic exploring monocular and stereo camera solutions, it is also exploring how best to integrate those sensors with radar and lidar. Panasonic produces 79 GHz radar sensors and ultrasonic sensors.

In February 2015, Panasonic and partner Imec demonstrated a 28nm CMOS millimeter wave radar chip, a potentially lower cost alternative for ADAS applications.

Deep Learning

A significant share of the FY 2019 sales target, roughly 10% of the total, will come from Panasonic’s collaborations with partners and from acquisitions. One such collaboration is with Preferred Networks Inc. to apply deep learning to advanced driver assistance systems. According to the Wall Street Journal, “Preferred Networks would provide software to beef up Panasonic’s offerings in advanced driver assistance systems.” Established in March 2014, Preferred Networks has offices in Tokyo and San Mateo, California.

* Environment

The Environment segment of Panasonic’s automotive business has set a sales goal of ¥700 billion for FY 2019, an 18.6% annual growth rate from FY 2015’s ¥380 billion total. Its two main product lines are power supply systems and chargers, and batteries. Automotive batteries will account for a majority of sales.

Tesla Gigafactory

In July 2014, Panasonic and Tesla Motors signed an agreement to cooperate in the construction of a large-scale battery manufacturing plant, known as the Gigafactory. Tesla will prepare and manage the land, building and utilities currently under construction in Nevada. Panasonic will manufacture and supply cylindrical lithium-ion cells and will invest in the associated equipment and manufacturing tools.

Tesla will use the Panasonic cells to assemble battery modules and packs. Panasonic will occupy approximately half of the planned manufacturing space; Tesla’s module and pack assembly operation, along with other component suppliers, will occupy the other half of this large, integrated industrial complex.

The factory will produce cells, modules, and packs for Tesla’s electric vehicles and for the stationary storage market, beginning in 2016. The factory plans to produce 35 GWh (gigawatt-hours) of cells and 50 GWh of packs per year by 2020.

Projected 2020 Electric Vehicle Battery Market by Supplier Share

Source: Lux Research

Other suppliers, 9%
Panasonic, 51%
LG Chem, 24%
Samsung SGI, 4%
LG Chem, 24%
*Separately from Lux Research, Panasonic has forecasted that by FY 2019, its lithium-ion batteries will be installed in 34% of the electric and hybrid vehicles that require them, up from 20% of vehicles in FY 2015.
**Contract not yet assigned. Nissan gets most of its batteries from AESC, its joint venture with NEC. LG Chem supplies Renault.
Mr. Buczkowski is open to what is going on with the Genivi and Automotive Grade Linux open source projects, but Ford hasn’t yet made any commitments. “We are still in the evaluation stage,” he said. Sync 3 is based on QNX.

**Cybersecurity and Privacy**

“As vehicles get connected to the external environment we open up attack surfaces. We have to use whatever technology we can find or invent to protect against hackers, who will get smarter as we get smarter. Cybersecurity is an important area we are putting a lot of effort into, and we’ll continue to work together with the SAE, with NHTSA and others to address this challenge.”

**Standards**

- **Ethernet**
  
  Looking for low cost and high performance, Ford is researching two-wire, automotive-grade Ethernet as an answer to the anticipated growth in data traffic. “Ethernet is very important to us,” he said. Ford is also working with CAN-FD.

- **SmartDeviceLink**
  
  Available on Ford vehicles, Sync AppLink is software from Ford that lets drivers interact with their smartphone apps using the vehicle’s display and voice or manual controls. SmartDeviceLink (SDL) is the open source version of AppLink, a standard that Ford would like other carmakers to adopt. With more carmakers using SDL, the ecosystem of app developers will grow, providing an alternative to Apple CarPlay and Google’s Android Auto. This past June, Toyota announced it would explore collaborating with Ford subsidiary Livio for an implementation of SDL.

  “We have more than 60 applications around the world that work with AppLink,” said Mr. Buczkowski. “We intend to grow that.”

- **Autosar**
  
  While Ford is not opposed to using ECUs that have Autosar software in them, Autosar is not a requirement. Ford won’t promote or require Autosar until actual quotes from suppliers prove that products based on the standard will save Ford money.

**Software**

In mid-October Tesla began distributing an advanced set of autonomous driving features to 50,000 newer Model S car owners worldwide via an over-the-air software download. The feature will enable hands-and-feet-free driving as long as the driver touches the steering wheel at least every 10 seconds. Tesla owners will have to pay $2,500 to activate the feature.

I asked Mr. Buczkowski what Ford has learned from Tesla. “Tesla came at the vehicle from a software point of view. They looked at the vehicle—at least we think they did—as a software platform. That adds energy behind our efforts to recognize and change our organization over time to be more of a software-driven organization.”

**Flatter Supply Chain**

In the past, Ford’s chain of suppliers was more hierarchical—a tier-one supplier would go find all the technology it needed for a system and build that system for Ford. That is changing. Now Ford is looking for new technology not only from the tier ones but also from the next tier of suppliers. Mr. Buczkowski cited HERE on maps and TeleNav on navigation as examples of this approach. Ford is forming relationships not only with established suppliers but also with startups and businesses outside the normal automotive supply chain.

“Today we are opening it up to almost anybody who feels they have something new or innovative that will have high value to consumers,” said Mr. Buczkowski. “We invite potential partners to come talk to us and show us what they have to offer.”

**AEB Competition**

10 million miles of validation data, roughly 70% of it is with radar data. ... Radar/camera fusion is done on the EyeQ.” The EyeQ chip isn’t processing raw radar data; that is done separately. Rather, EyeQ takes targets and candidate targets from the radar sensor, and fuses those with what the camera image processor has discerned.

Freescale, CogniVue, Neusoft

In March 2015, Freescale began publicizing its new vision microcontroller, the S32V234K, which takes aim at the same front-facing camera processing applications now served by Mobileye’s EyeQ chips. The device comes with image cognition IP from CogniVue. Image cognition processors are programmable engines used to implement typical machine vision algorithms. “This is a low PPM device designed to be [ISO 26262] ASIL B compliant by construction; it can be ASIL C with software,” noted Davide Santo, global ADAS microcontroller product line manager at Freescale.

In September, Freescale completed the purchase of CogniVue. Freescale is being acquired by NXP.

Neusoft, the largest IT solutions and services provider in China, with more than 20,000 employees, has a non-exclusive partnership with Freescale. At Freescale’s Technology Forum last June, Neusoft demonstrated its pedestrian detection, traffic sign recognition and lane departure warning applications, all running on the S32V. As a result of its cooperation with Freescale, Neusoft signed its first deal with an American tier one. “This first product based on the Freescale platform is still in the R&D phase; it won’t make it to the streets before early 2018,” said Niko Böker, marketing director at Neusoft Automotive.

According to Mr. Santo, “The market is very hungry for alternatives to Mobileye.”

**Mobileye’s Tier-One Partners**

- Autoliv
- Mando
- Bendix
- Mobis
- Delphi
- Nidec Elesys
- Gentex
- Sony
- Hi Rain
- Taiwan Calsonic
- Kostal
- TRW
- KSS
- Valeo
- Magna

*Mobileye still sells chips to Gentex and Autoliv, but isn’t working with them on new RFQs.*