BREAKOUT 16: AFTERMARKET SYSTEMS (ADAS-RELATED)

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CAR MAKERS STRUGGLING WITH CHANGE

• Adding connectivity
• Adding sensors and safety
• Driving toward autonomy

• But before we get there – industry must sort out
  • Privacy, Security, Data acquisition/aggregation/management
  • The fundamental business model behind connected – autonomous vehicles

• The latest wrinkle is data collection – how much, which data, how to monetize, how to mitigate the cost

• = Plenty of running room for aftermarket opportunity
WHAT WE’RE TRYING TO ENABLE
WHAT WE MAY HAVE TO SETTLE FOR
SOCIAL GRAPH VS. SENSORS

CarPlay
Android Auto
Baidu Life

Navigation, streaming, traffic, weather, location

MirrorLink
SD Link
InControl etc.

Remote vehicle access, control, sharing, diagnostics, tracking

“We’re going to build a wall!”
• 2022 production down from 113.8 M in Q2 2015 forecast to 109.4M in Q2 2016 forecast – a 4% drop
• Most risks remain on the downside

Source: LMC Automotive Jun 2016
• 2022 system demand up from $331B in July 2015 forecast to $346B in July 2016 forecast – a 5% rise
• Expected demand for body & chassis systems is now flat or lower. These systems typically have very high penetration rates, and thus are hit by production changes.

• Expected demand for powertrain & driver info up a little. Higher volumes expected for HEV/EV, as well as more complex cluster etc.

• Biggest gain in safety – driven by increasing ADAS demand
• Growth outside of ADAS and HEV/EV is comparatively weak. These two systems areas are the major growth drivers. More risk to HEV/EV forecast than for ADAS. Most ADAS risk is on the upside, in the event of more legislation.
WHY’S ADAS GROWING SO FAST?

• Governments continue to push for greater road safety
  • Far too many road deaths! Strong push from EuroNCAP. Growing incentives from other NCAP authorities and bodies – e.g. IIHS

• Automakers need new features; consumer interest is growing

• Prices are coming down – now typically in the $00s not $000s

• Many ADAS systems are on evolutionary path to autonomous driving

Source: Volvo
CONSUMER ADAS INTEREST IS GROWING

In general consumers are getting MORE interested in ADAS and autonomous features

Caveat: Willingness to pay remains modest!

2015 survey included:
- 1200 consumers in US
- 1200 consumers in Europe (split UK/FR/IT/DE)
- 2000 consumers in China

Source: Strategy Analytics In-Vehicle User Experience Team – April 2015
GROWTH FOR ALL SYSTEM TYPES…

- Fastest $ growth is forecast to be in Head-Up-Display and Surround View Systems
- Growth in almost all systems except for ultrasonic-only park assist
- Most systems seeing $ market growth at 15%/yr or higher

October 2015
Strategy Analytics, Inc
• Cars manufactured in NAFTA, Europe and Japan will have the highest ADAS content
• Content to remain minimal in some regions – e.g. India
• Cameras offer best combination of growth and volume.
• Ultrasonic sensors not included in above charts: there is still growth here, reaching over 290 million sensors by 2019
WHY VISION-BASED ADAS?

• Camera sensors are low-cost
• A number of applications can ONLY be implemented with cameras – e.g. TSR
• Few, if any, applications cannot be implemented with a camera, even if it is not (yet?) the ideal solution
• SA thus expects the camera to be the ideal “base sensor” around which OEMs will build an ADAS strategy – and will be the most likely first ADAS sensor fitted to low-end vehicles

Source: TRW
• Center Stack: Infotainment companies to expand into ADAS?
• Sensor Clusters: How many? Who integrates? Architectures?
• HMI: How best to communicate? Legislation?
• Software: Who develops? Who owns?
• Fastest $ growth is for ADAS in light vehicles manufactured in China
• Europe largest market – best combination of size and growth for now
• Japanese growth hindered by falling vehicle production
EVOLUTION OF TELEMATICS

1.0 - OnStar – automatic crash notification
2.0 – OnStar et. Al. – diagnostics/prognostics
2.1 - Trafficland – rapid incident detection, reporting, response
2.2 - WayCare & Banjo – crash prediction, prevention response

3.0 - V2V – Collision avoidance
V2V/V2X

- Market development HIGHLY dependent upon mandates

- 802.11-based approaches seen as having huge business model challenges by Strategy Analytics. Who will pay for new, automotive-specific infrastructure?

- LTE/5G approaches can overcome these issues
  - Latency-critical applications should rely on on-board sensors
  - Yes, network coverage is not universal – but it is a lot wider than a dedicated automotive network could hope to be in any reasonable timeframe
  - 5G peer-to-peer capabilities will allow V2V even without network coverage

- Smartphones and apps
  - Speed to market
  - Consumer familiarity
  - Ubiquitous usage/device ownership

Dec 2nd 2015
Strategy Analytics, Inc
AI FOR COLLISION AVOIDANCE

Which is why on April 15, 2013, Patton and Banjo’s team were able to instantaneously look at the scene of the bombing in real time and help identify people of interest literally a few minutes after the bombing occurred.

“That’s when I knew we had something no one else had,” he says.

WHAT’S SO AWESOME ABOUT WAYCARE?

- **Accident Prediction**: WayCare’s proprietary, machine learning platform predicts traffic accidents and related congestion before they occur.
- **Decision Support System**: Decision support solution, which allow authorities to select the optimal preventative course of action.
- **SaaS based solution**: WayCare’s solution is SaaS based, every city is can easily become a smart-city without requiring costly infrastructural Investment.
Volvo’s vision of V2V via LTE, 5G

Sample Use Cases

- Connected Safety.
- Autonomous Driving.
- Amazingly Robust Navigation Systems.
DISRUPT CONNECTIVITY

BMW’s vision of V2V via LTE, 5G

VMS to dashboard

SPAT to dashboard

Map updating, editing

At intersections where there are dedicated traffic signals for turns, the activation of the vehicle’s turn indicator tells the app of the driver’s intention to turn so that only the status of the relevant signal is displayed.

ConnectedDrive permits a regular automatic navigation map update. The data are transferred “over the air” using the mobile SIM card installed and there are no licence charges or transmission costs for the user.
**E CLASS VS. MODEL S**

**Mercedes Benz**

**2017 E Class**

Total Number of Sensors: 23

- 12x Ultrasonic (six at the front, six at the rear)
- 4x Multi-Mode Radar (one at each corner)
- 4x Cameras (front, rear and one in each door mirror)
- 1x Long Range Radar (front)
- 1x Stereoscopic Multipurpose Camera (top of the windshield)
- 1x Steering column position sensor

**Tesla**

**Model S 2015**

Total Number of Sensors: 16

- 12x Ultrasonic Sensors (6 front, 6 rear)
- 1x Long-Range Radar (front bumper)
- 1x Image Recognition Camera (top of windshield)
- 1x Rear Camera (rear for parking trajectory)
- GPS Data Integration with real time traffic location based data.
WHAT WE’RE TRYING TO ENABLE
WHAT WE MAY HAVE TO SETTLE FOR
CONCLUSIONS

• ADAS features are one of the fastest growing application areas for automotive electronics
  • Growth across all system types, and now strongest in mainstream rather than premium vehicles
  • Camera sensors offer best growth/volume potential due to cost & flexibility
  • Maps important part of required feature set – but challenges exist for map vendors

• Move to more autonomous driving is part of an evolutionary continuum – and this is the best way for OEMs to address the opportunities
  • True (e.g. NHTSA level 4) full autonomy will not emerge in volume soon. Huge challenges to overcome!
  • Google is more revolutionary. Seeking to design the “car” for the post-car transportation industry

• OEMs thus need to keep in mind the revolutionary impacts while following the evolutionary path.
ANY QUESTIONS?
Mobile V2V, Intelligent Transportation & Data Analytics for Smart Cities
Tomorrow - Today

CORY HOHS
cory@haasalert.com
July 12, 2017 San Francisco
Automated Vehicle Symposium - ADAS Session
AUTOMOTIVE, BIG DATA and Large Scale TECHNOLOGY

CORY HOHS  
CEO / Co-Founder  
Navteq / Nokia – automotive, spatial mapping, data product integration

JIGAR PATEL  
CTO / Co-Founder  
JP Morgan – full-stack development, engineer, business analysis

DR. BRUNO FAZENDA, PhD  
DSP / Acoustic Engineer  
PhD, U of Salford – dsp & psychoacoustics

NOAH LEVENS  
COO / Co-Founder  
Leo Burnett – brand strategy, mobile, ux, ui, marketing

BOB STRUBLE  
Former iBiquity Strategy + Board of Directors

LARRY KAPLAN  
Former CEO - Navteq Pricing

JOHN ELLIS  
Former Global Technologist - Ford Platform

JACKIE McCARTHY  
Executive Director - CTIA Mobile Infrastructure Strategy

GABE KLEIN  
Smart City & DOT Strategy - CityFi Scalability

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Chicago, 2014

Founder was nearly struck by an ambulance while on a motorcycle. Upon research into how best to alert drivers in this scenario, the team realized there was no good solution and the problem needed solving.
SLOW DOWN - Technicians in the road ahead
PARTNER ORGANIZATIONS

• U.S. Department of Homeland Security
• National Safety Council
• Road to Zero Coalition
• Michigan DOT Traffic - Incident Management
• Move Over Michigan
• Illinois Fire Chiefs Association
• NY State Association of Fire Chiefs
• Firehouse Media

• CREST Center
• CTIA
• Coal Belt Association for First Responders
• NIST Public Safety Super Cluster
• NFPA (National Fire Protection Association)
• FAMA (Fire Apparatus Manufacturers Association)
• FEMSA (Fire and Emergency Manufacturers and Services Association)
Police Officers and Firefighters have a higher risk of death and injury traveling to the scene of an incident than at the scene itself.

- National Law Enforcement Officer’s Memorial Fund
Cities have a **DATA PROBLEM**, not a tech problem.

**TODAY**

- 60,000/year First Responder accidents in U.S.
- $1M every time an injury is incurred
- Chicago paid $8M*, LA over $20M*
- Bluetooth everywhere
- No solution yet on the market

**~10x**

**TOMORROW**

- 75% vehicles connected by 2020
- Driver Distraction
- Advanced Infotainment
- Autonomous Vehicles
- Traffic & Smart City
- Sound insulated cabins

- *Chicago Tribune & LA Times

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DATA CREATION
Multiple Solutions Connect Cities & Fleets

DIRECT DATA

MOBILE / ACOUSTIC

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IoT SMART CITY
SENSOR

DATA CREATION
Multiple Solutions Connect Cities & Fleets

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Responders and city agencies broadcast to motorists in real-time.

For autonomy, more important for the vehicle to know than the driver.
SQUAD 07
Nickname 07

Device Totals
Total Drivers Alerted
102
Total Incidents Total Points
44 9,789

Active Device Location
1450 SW KENTUCKY AVE
Arrived 10:22 AM

Recent Device Locations

Vehicle Runs Per Day

Last Month (Avg.)
9
Last Week (Avg.)
10
Yesterday (Total)
8
Today (Total)
6
Letting us know the *future* events ahead.
ULTRASONIC (~3m)

CAMERA (~80m)

LONG-RANGE RADAR (~150m)

CAMERA (~80m)

SHORT-RANGE RADAR (~20m)

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@haasalert
Augmenting *Micro* Perception
Allows for preemptive and proactive vehicle/driver notifications, not last second collision avoidance.

Cellular is the first alert.
HAAS ALERT data sets can go to work today with intelligent systems & connected infrastructure
Current short-range sensors inform SPaT over short distances
HAAS ALERT real-time data sets can inform SPaT and other infrastructure (i.e. street lights) over any distance.

Current short-range sensors inform SPaT over short distances.
7 CITIES EMERGENCY VEHICLES
- Palo Alto CA
- Chicago IL
- Belmont CA
- Grand Rapids MI
- Detroit MI
- Austin TX
- Portland OR

SINCE AUGUST 2016
- 2,436 drivers alerted
- 3,879,205 responder alerts

WITH CONTINUED GROWTH
- 14 cities in pipeline + 350 Vehicles
- DOT Support for rapid expansion

@haasalert
HAAS Alert Safety Cloud already integrated with Waze.
Integrated with a major OEM production pilot. A true *real-time* connected cellular in-dash from the HAAS Alert Safety Cloud.
Nexar
Driving Safer. Together.

Nexar
July 2017
VISION

INTELLIGENT VEHICLE-TO-VEHICLE NETWORK MANAGEMENT for ALL DRIVERS AND ROADS
MISSION

A WORLD WITHOUT CAR CRASHES
AI DASHCAM
AN ADAS + V2V APP TO SEED THE NETWORK

1. In-cabin recording
2. Limitless Cloud storage
3. ADAS Warnings and automatic crash detection
4. V2V over cellular at less than 150ms latency
5. Voice activated
6. Approved by Insurance
THE CURRENT PATH IS SLOW
MUCH TALK, NOT ENOUGH (TR)ACTION

2%
of vehicles in the world with some form of driver assistance or automation

10%
of vehicles sold every year with some form of driver assistance or automation
AUTOMOTIVE SAFETY IS OPTIONAL

BILLIONS of

CONSUMERS

all over the world choose between safety and entertainment

$2,000 average “advanced driving” premium package

$2,000 average infotainment premium package
AVIATION SAFETY BY FRANK KAFKA

Club World  
35 seats  
Complementary soft drinks

World Traveller Plus  
25 seats  
Premium check-in and meal included

World Traveller  
154 seats  
Premium check-in, lounge access, meal and life vest included
<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>INSIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 years</td>
<td>11.6 seconds</td>
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from model development to SoC on vehicle entering production line

time between software deployments at Amazon
SOFTWARE-CENTRIC PRODUCT DEVELOPMENT
THE TRUE AUTOMOTIVE REVOLUTION

PRODUCT VALUE
SPEED
TIME TO MARKET
Continuous improvement

LOW FRICTION
Ease of distribution

SOFTWARE
COST
NO-FEATURE
Commoditize safety

MARGINALLY FREE
Zero cost at scale

HARDWARE
ECOSYSTEM
UNIVERSAL AFTERMARKET
Any make, model, or year

PARTNERS
Augment, empower and accelerate
AI, SENSOR FUSION, V2V

PREMIUM SOFTWARE + SMARTPHONE

COMMODITY HARDWARE = FASTER VELOCITY TO MARKET

DISRUPTED MARKET
HARDWARE

ECOSYSTEM

USB cameras

Wifi cameras

In-Vehicle Integrations

Dedicated Fleet Hardware
SOFTWARE WILL MAKE ADVANCED DRIVER ASSISTANCE A COMMODITY FOR ALL DRIVERS AND ROADS
SOFTWARE WILL MAKE VEHICLE TO VEHICLE A REALITY FOR ALL DRIVERS AND ROADS
NEXAR’S SOFTWARE APPROACH
LEADING IN DATA VOLUME AND DIVERSITY

VIDEOS
100’S M
road video
miles/year

LIGHTING
- Day: 49%
- Night: 49%
- Twilight: 2%

+1,400
+80

cities
countries
NEXAR FOR AUTOMOTIVE SOFTWARE SOLUTIONS

1. state-of-the-art algorithms in computer vision and deep learning for automotive perception

2. world’s leading V2V deployment deploy V2V applications today over cellular network communications

3. claims automation deep collision reconstructions to drive partnership with insurance carriers

4. real-world driving data platform to collect and store video and sensor data from the car’s resident systems
NEXAR ADAS WARNINGS
ON-DEVICE REAL-TIME PERCEPTION

Nexar’s network of moving cameras continuously improves the deep learnings models with unprecedented speed of learning.
Predicting The Future (Egomotion)
PERCEPTION ADAS
FCW

MACHINE VISION
Forward collision alerts

V2V ADAS
FCW

NETWORK CONNECTIVITY
Vehicle-to-Vehicle (V2V) forward collision alerts
PERCEPTION ADAS
SCENARIOS

LANE DEPARTURE WARNING

PEDESTRIAN WARNING
V2V NETWORK
SCENARIOS

LEFT TURN ASSIST

DO NOT PASS WARNING

INTERSECTION MOVEMENT ASSIST
NUMBER OF RIDES: 101
ADDRESS: Broadway and West 56th Street
LEVEL: Up to 102 rides

NOW

100 /day times we see Manhattan

BY EOY 2017

1 / minute times we see Manhattan

MORE

CITIES

New York, Las Vegas, Tel Aviv, San Francisco
NEXAR COLLISION RECONSTRUCTION REPORT

Nexar is an AI-powered dashcam smartphone app that uses a combination of machine vision and sensor fusion algorithms to reconstruct road collisions. Nexar auto-detects hard breaks and collisions and creates an incident starting 20 seconds prior to the event, and ending 20 seconds post the event. This event is then uploaded to the cloud, to generate the reconstruction below. For additional information about how Nexar works and the methodology used in generating this report, please contact Nexar at: contact@getnexarlcom
COLLISION OVERVIEW

Jaime Covarrubias was driving on Bayshore Fwy [426A] heading North East.

TIMELINE:

10:06:47.0 AM
Jaime Covarrubias was driving on the right lane at speed of 50 mph when vehicle with license plate 7PQB783 was braking after missing the exit to Bayshore Blvd Cow Palace, partially moving to the road shoulder.

10:06:49.0 AM
Jaime Covarrubias starts braking.

10:06:52.0 AM
Jaime Covarrubias reaches near full stop when vehicle with license plate SANJEH hits him from behind at force of 3.3 G for 60 milliseconds, and approximated speed of 8 mph causing the car to leap forward while spinning 48 degrees to the left.

10:06:54.0 AM
Jaime Covarrubias stops spinning.

10:06:58.0 AM
Jaime Covarrubias moves to the road shoulder.

WHIPLASH RISK:

40% chance for initial symptoms.
Below 10% chance for symptoms after a month.

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COLLISION AREA

MAP OF THE DRIVING PATH AND THE LOCATION OF THE COLLISION
COLLISION RECONSTRUCTION

DRIVER NAME: Jaime Covarrubias
COLLISION TIME: 26 Mar 2016 10:06:53 AM PST
COLLISION URL: http://nxr.cm/258f8b4b80...

DASHCAM

FOUR DASHCAM IMAGES RECORDED BEFORE THE COLLISION
1/sec (left to right)

THE CAR DASHCAM IMAGE AT THE MOMENT OF THE CRASH

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COLLISION RECONSTRUCTION

COLLISION DIAGRAM

SPEED ANALYSIS

* GPS speed estimation has a latency of about 1 second. After the impact, GPS accuracy decreases and speed measurement is no longer accurate.
COLLISION DYNAMICS

The device was positioned in landscape mode.
The following graph depicts the forces exerted on the car in all directions.

- Collision detected
- Vehicle reaches full stop
- Hard brake
- Hard brake and spin

Time [HH:MM:SS]
COLLISION RECONSTRUCTION

COLLISION OVERVIEW

ZOOM TO THE CRASH TIME

Collision detected, impact force peak of 3.3G

Hit angle average is 25 degrees clockwise to the car heading

CAR ROTATION DUE TO THE ACCIDENT

Vehicle rotating to the right due to the impact

Time [HH:MM:SS]

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IMPACT ON JAIME COVARRUBIAS
COLLISION RECONSTRUCTION

HITTING CAR [SANJEH]:

CAR THAT STOPPED AFTER THE EXIT [7PQB783]

DRIVER NAME: Jaime Covarrubias
COLLISION TIME: 26 Mar 2016 10:06:53 AM PST
COLLISION URL: http://nxr.cm/258f8b80...
3D RECONSTRUCTION
I don’t feel comfortable driving without Nexar anymore.
PARTNERSHIPS

10% OFF
Multiple NYC Carrier Partnership discounts for drivers

REPORTS

WEEKLY
Activity reports for insurers

COLLISION REDUCTION

25%
per 1 million miles in first 6 months

SAVINGS

$500 per Vehicle
in 2017 insurance premiums for drivers in Manhattan
VISION TELEMATICS
NEXAR DATA ENABLES NEW MODELS

SPEED  ACCELERATION  ROAD TYPE

YIELDING

HARD BRAKE

MILEAGE  HARD CORNERING  TIME OF DAY

SWARM

HEADWAY DISTANCE
FASTER VIA VISION
UNIQUE DRIVER RISK PROFILE

DIFFERENT FOLLOW-DISTANCE DRIVING STYLE

SPEED
1 hr vs. 3 mo
changes the UBI Business Model

1 hr 3 mo

Mary, Ride 1
Mary, Ride 2
John, Ride 1
John, Ride 2

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COMPREHENSIVE RISK MANAGEMENT FOR VEHICLE FLEETS

ADAS WARNINGS
- avoid crashes
- improve vehicle utilization
- reduce loss

COLLISION RECONSTRUCTION
- remove incertitude
- reduce downtime
- cut claim admin cost

VISION TELEMATICS
- fast and precise driver profiling
- low friction deployment
IDENTIFY DANGEROUS INTERSECTIONS AND HOTSPOTS
DETECT POTHOLES AND TRACK INFRASTRUCTURE
IDENTIFY OBSTACLES IN REAL TIME
THANK YOU
July 2017