Michigan Connected and Automated Vehicle Working Group

June 3, 2016

Meeting Packet

1. Agenda
2. Meeting Notes
3. Attendance List
4. Presentations

Michigan Connected and Automated Vehicle Working Group

June 3, 2016

Intelligent Ground Vehicle Competition
Oakland University
Rochester, MI 48309-4401

Meeting Agenda

11:30 AM	**Lunch and Networking**
11:45 AM	**Welcome and Introductions** Adela Spulber, Transportation Systems Analyst, Center for Automotive Research Gerald Lane, Co-Chairman & Co-Founder, IGVC
12:30 PM	**Connected Vehicle Virtual Trade Show** Linda Daichendt, Executive President/Director, Mobile Technology Association of Michigan
12:50 PM	**Overview of the American Center for Mobility (i.e., Willow Run test site)** Andrew Smart, CTO, American Center for Mobility
01:10 PM	**From Park Assist to Automated Driving** Amine Taleb, Manager - Advanced Projects, Valeo North America Inc.
01:30 PM	**Advanced Vehicle Automation and Convoying Programs at TARDEC** Bernard Theisen, Engineer, TARDEC
01:50 PM	**Overview of the SAE Battelle CyberAuto Challenge** Karl Heimer, Founder/Partner, AutoImmune (and co-founder of the Challenge)
02:10 PM	**Continental – Oakland University Joint Project on ADAS Test & Validation** Irfan Baftiu, Engineering Supervisor, Continental Automotive Systems
02:30 PM	**Watch IGVC teams practice and test on the course**
03:00 PM	**Adjourn**

Michigan Connected and Automated Vehicle Working Group

The Michigan Connected and Automated Vehicle Working Group held a special edition meeting on June 3rd 2016, during Intelligent Ground Vehicle Competition (IGVC) at the Oakland University in Rochester, Michigan.

Meeting Notes

Adela Spulber, Transportation Systems Analyst at the Center for Automotive Research (CAR), started the meeting by detailing the agenda of the day and working group mission.

Gerald Lane, Co-Chairman & Co-Founder of the IGVC, welcomed the Working Group to the 24th annual Intelligent Ground Vehicle Competition. Gerald gave an introduction of the IGVC, a competition aimed at university and college students, and focusing on the design, fabrication, and field testing of autonomous intelligent mobile robots. The IGVC started in 1993 and has brought together more than 500 teams from 80 universities and seven countries. Gerald gave details on each step of the competition, as well as information about the 2015 edition. The presentation included in the meeting packet also shows the results of the 2016 race.

Following Gerald Lane's presentation, Linda Daichendt, Executive President/Director of the Mobile Technology Association of Michigan (MTAM), provided a brief overview of the Connected Vehicle Virtual Trade Show, which is part of the larger connected vehicle environment that the USDOT helps develop. The Virtual Trade Show, set up by MTAM for USDOT, aims at bringing together companies in the connected vehicle sector and helping with the selection of vendors for the Connected Vehicle Safety Pilot Program. Linda showed a demo video that explains the functioning of the Virtual Trade Show. The video is also available on Youtube: https://youtu.be/l6J01RqU0I4.

After Linda Daichendt's presentation, Andrew Smart, CTO of the American Center for Mobility (ACM), gave an update on the development of this new connected and automated vehicle testing environment on the Willow Run site. ACM is structured as a non-profit connected and automated vehicle testing and product development facility, designed to accelerate the development of voluntary standards and technology deployment. ACM will be complementary to MCity. Its bigger scale will allow for high speed testing, by incorporating a part of US 12 highway, as well as testing in residential and commercial environments.

Amine Taleb, Manager of Advanced Projects at Valeo North America Inc., talked about the transition from park assist to automated driving from the perspective of the product development at Valeo. Amine highlighted several evolution steps, including the 1991 Ultrasonic (park assist), the 2007 Park4U (semi-automatic parking), the 2010 Park4U 2.0 (perpendicular parking with active braking), the 2011

FlankGuard (360 degrees park assist), the 2013 Auto Park4U (fully-automatic parking), the 2014 Park4U 3.0 (forward parking), and finally the 2016 Park4U Remote (with sensor fusion and remote command).

Bernard Theisen, Engineer at TARDEC provided an update on the Advanced Vehicle Automation and Convoying Programs at TARDEC. Bernard also talked about the need to create more linkages between the industry of commercial vehicles and the Department of Defense and gave details about the DSRC-enabled platooning test that TARDEC is conducting in June on I-69.

Following Bernard Theisen, Karl Heimer, Founder/Partner of AutoImmune spoke about the SAE Battelle CyberAuto Challenge, that is takeing place this year on July 25-29 in Warren, Michigan. The Challenge brings together students, engineers from the automotive industry, white-hat hackers, and government representatives. Its purpose is to develop the future workforce, create mentor-protégé relationships, and help forge the vehicle cybersecurity community.

After the end of the meeting, the members of the CAV Working Group had the chance to watch IGVC teams practice and test on the course.

MDOT maintains a webpage dedicated to its work related to CAV technologies (http://www.michigan.gov/mdot/0,1607,7-151-9621_11041_38217---,00.html). The page includes documents, presentations, and other materials that may be of interest to CAV stakeholders. Meeting packets containing materials (e.g., agenda, meeting notes, attendance, and presentation slides) from past Michigan Connected and Automated Vehicle Working Group meetings can also be found on the page in the bottom right corner under the heading Connected Vehicles Working Group.

Michigan Connected and Automated Vehicle Working Group

Attendance List

First name	Last name	Organization	Email
Mohamad	Abdul-Hak	Mercedes Benz Research & Development North America, Inc	mohamad.abdul-hak@daimler.com
David	Agnew	Mobis	dagnew@mobis-usa.com
Niles	Annelin	MDOT	annelinn@michigan.gov
Jeff	Blackburn	TASS	jeff.blackburn@tassinternational.com
Danielle	Bowman	WIN	danielle.bowman@win-semich.org
Patrick	Brunett	Quanergy	patrick.brunett@quanergy.com
Collin	Castle	MDOT	castlec@michigan.gov
Toni	Chen	Mitsubishi Electric Automotive America	TChen@meaa.mea.com
Russell	Chick	Spartan Motors	russell.chick@spartanmotors.com
Steve	Crain	Integral Blue	stevecrain@integral-blue.com
Linda	Daichendt	MTAM	linda@gomobilemichigan.org
Liana	Daltoe	Industry Canada	liana.daltoe@canada.ca
Eric Paul	Dennis	CAR	epdennis@cargroup.org
Bob	Feldmaier	Macomb CC	feldmaierr@macomb.edu
Joseph	Frikken	Ricardo	Joseph.Frikken@Ricardo.com
Christophe	Gaillard	Aisin	cgaillard@aisintca.com
Anthony	Gasiorowski	WSP / PB	gasiorowski@pbworld.com
John	Geisler	MAMA	john@michman.org
Matt	Genesco	Michigan Environmental Council	genescom@msu.edu
Colin	Goldsmith	P3 North America Inc.	Colin.Goldsmith@p3-group.com
Andrew	Harding	UL	andrew.harding@ul.com
Karl	Heimer	AutoImmune	karl.heimer.pro@gmail.com
Jerry	Lane	GLS&T	gerald.lane50@gmail.com
Cassi	Meitl	Detroit Regional Chamber	cmeitl@detroitchamber.com
Mahendra	Muli	dSpace	mmuli@dspaceinc.com
Andrew	Nam	Stoneridge	andrew.nam@stoneridge.com
Frank	Perry	Leidos	frank.perry@leidos.com
Mohammad	Poorsartep	TTI	m-poorsartep@ttimail.tamu.edu
Ann	Schlenker	Argonne	aschlenker@anl.gov

First name	Last name	Organization	Email
Andrew	Simpson	Mitsubishi Motors	andrew.simpson@na.mitsubishi-motors.com
Andrew	Smart	American Center for Mobility	andrew.smart@americancenterformobility.org
Wayne	Snyder	NextEnergy	waynes@nextenergy.org
Adela	Spulber	CAR	aspulber@cargroup.org
Gary	Streelman	Magneti Marelli	gary.streelman@magnetimarelli.com
Amine	Taleb	Valeo	amine.taleb@valeo.com
Sarah	Tennant	MSCWDB	stennant@macomb-stclairworks.org
Bernard	Theisen	TARDEC	bernard.l.theisen.civ@mail.mil
Jennifer	Tisdale	MEDC	tisdalej1@michigan.org
Lou	Wassel	Chrome Star	wassel@chromestarhr.com
Gerald	Wing	Mitsubishi Motors	gerald.wing@na.mitsubishi-motors.com
Ken	Yang	AECOM	qingyan.yang@aecom.com
Kenneth	Zurawski	FEV	zurawski@fev.com
Jeff	Durst	U.S. Army ERDC	phillip.j.durst@erdc.dren.mil
Andrew	Bushner	U.S. Army CERDEC	andrew.d.bushner.civ@mail.mil
Jeremy	Martin	MITRE	jtmartin@mitre.org
Udam	Silva	U.S. Army CERDEC	udam.s.silva.civ@mail.mil

Michigan Connected and Automated Vehicle Working Group

Presentations

Michigan Connected and Automated Vehicle Working Group

Intelligent Ground Vehicle Competition

Oakland University, Rochester

June 3, 2016

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Working Group Mission

Cooperatively pursue projects and other activities that are best accomplished through partnerships between multiple agencies, companies, universities, and other organizations and that ultimately advance Michigan's leadership position in connected and automated vehicle research, deployment, and operations.

Goals

- Benefit our state and our industry (automotive and more)
- Enhance safety and mobility in Michigan and beyond

Connected & Automated Vehicle Working Group
Welcome to the
The 24th Annual
Intelligent Ground Vehicle Competition:

Jerry Lane GLS&T
KaC Cheok Oakland Univ.
Bernard Theisen TARDEC
Andrew Kosinski TARDEC

2016 Grand Award Winners

- 1st Place Lawrence Technological University (LTU)
- 2nd Place Bluefield State College
- 3rd Place University of Michigan Dearborn

2016 Teams

2016 DESIGN PRESENTATION SCHEDULE								
			Design Group A		Design Group B		Design Group C	
	Judges		Fruechte, Tarakhovsky, MacKenzie		Zorka, O'Malley, Fleck		Agnew, Saxonn, Tumavich	
			Saturday, June 4					
	8:00 AM	8:30 AM	JUDGES MEETING - TENT 'A'		JUDGES MEETING - TENT 'A'		JUDGES MEETING - TENT 'A'	
1	8:30 AM	9:00 AM	~~Wentworth Institute of Technology~~	~~C.L.O.V.E.R~~	~~University of Colorado Denver~~	~~Sparky~~	~~Florida Institute of Technology~~	~~Florida RAS~~
2	9:00 PM	9:30 AM	The Citadel	PabloBot	~~Rose-Hulman Institute of Technology~~	~~Astraeus~~	The College of New Jersey	Moroccan Monster
3	9:30 AM	######	Indian Institute of Technology - Kharagp	Eklavya 5.0	University of Calgary	Taurus	Michigan Tech	Charlie
	10:30 AM	11:00 AM	BREAK - BREAK - BREAK		BREAK - BREAK - BREAK		BREAK - BREAK - BREAK	
4	#######	######	Lawrence Technological University	BigFoot 2	Bluefield State College	Apollo II	Oakland University	Schildkrote
5	11:00 AM	11:30 AM	~~Universite' de Moncton~~	~~Betsy~~	Bob Jones University	Kenxia	University of Illinois - Chicago	R.E.V.0
6	11:30 AM	######	Ecole de Technologie Superieure	CAPRA7	~~Missouri University of Sci. & Techn.~~	~~S&T Pathfinder~~	University of Michigan - Dearborn	OHM 4.0
7	12:00 PM	12:30 PM	University of Central Florida	Metaknight	Indian Institute of Technology - Bomba	Sedrica	Old Dominion University	Cilantro
	12:30PM	1:00 PM	LUNCH - LUNCH - LUNCH		LUNCH - LUNCH - LUNCH		LUNCH - LUNCH - LUNCH	
8	1:00 PM	1:30 PM	Georgia Institute of Technology	Jaymi	~~Instit. Techn de Estud. Super de Mont~~	~~Little Jump~~	Linfield College	Linfield WildCat
9	1:30 PM	2:00 PM	~~California State University Fullerton~~	~~Netra~~	Louisiana State University	Bengle Bot	Istanbul Technical University	AUTOBEE
0	2:00 PM	2:30 PM	University of West Florida	HAL	Lawrence Technological University	EulSpill	Embry Riddle	Z3RO
	2:30 PM	3:00 PM	BREAK - BREAK - BREAK		BREAK - BREAK - BREAK		BREAK - BREAK - BREAK	
11	3:00 PM	3:30 PM	University of Cincinnati	Dokalman	United States Military Academy	IGGY	Stony Brook University	Project Wilhelm
2	3:30 PM	4:00 PM	Oakland University	Octagon	University of British Colombia	Snowstorm	Trinity College	EARL

2016 Sponsors

Platinum Sponsors - Northrop Grumman, Hyundai Mobis & AUVSI Foundation:

Elite Sponsor - Magna:

Gold Sponsors - ClearPath Robotics, Roush, NDIA & Molex:

Sponsor - TORC Robotics:

IGVC Objective

- University & College students to think creatively as a team
- Focus on evolving technologies of vehicle electronic controls, sensors, computer science, robotics, and system integration
- Design, Report Fabrication, and Field Testing
- Autonomous intelligent mobile robots.

IGVC Schedule - 4 Days

- **Friday**
  - Teams Arrive register
  - Setup in tent and practice
  - Qualification Opens
- **Saturday**
  - Qualification
  - Design Competition First Round all day
  - Heat 1 of Auto-Nav- Basic
  - IOP Challenge begins
- **Sunday**
  - Qualification
  - Heats 2 & 3 of Auto-Nav-Basic
  - Heat 1 Auto-Nav Advanced
  - Design Competition Finals
  - IOP Challenge
- **Monday**
  - Qualification
  - Heats 4 & 5 of Auto-Nav-Basic
  - Heat 2&3 Auto-Nav Adv
  - Awards

IGVC Challenges

- Mandatory Design Competition
  - Design Report
  - Student Presentation
  - Vehicle Inspection
- Autonomous Driving & Navigation
  - Fully Autonomous
  - Must Qualify Autonomous Driving & Navigation
  - Basic Course
  - Advanced Course
- Interoperbility IOP Architecture

Competition History

1993 - 2012 Autonomous Challenge

1995 Design Competition

1999 – 2000 Road Debris Course

1999 – 2001, 2003 Follower The Leader

2001 – 2012 Navigation Challenge

2006 – 2013 JAUS Challenge

2013 Auto-Nav Challenge

2014 IOP Challenge

24 Years and Running

500+ Teams

80+ Universities

7 Countries

2015 Participating Schools

Bluefield State College	2015 Schools	Universite' de Moncton
California State University-Northridge	Michigan Technological University	University of British Columbia
École de technologie supérieure	Oakland University	University of Central Florida
Embry-Riddle Aeronautical University	Oakland University 2	University of Cincinnati
Georgia Institute of Technology	Southern Illinois University - Edwardsville	University of Detroit Mercy
Hosei University	The Citadel	University of Illinois - Chicago
Indian Institute of Technology-Kharagpur	Trinity College	University of Michigan-Dearborn
Lawrence Technological University	United States Military Academy	University of New South Wales
Lawrence Technological University 2	United States Naval Academy	University of West Florida

Qualification

Safety is a top priority at IGVC. Before the vehicles can compete in any of the performance events, all vehicles must pass Qualification. To complete Qualification the vehicle must be put in autonomous mode to verify the mechanical and wireless E-stops and to verify minimum speed, lane following, obstacle avoidance and waypoint navigation.

The vehicle software cannot be reconfigured after Qualification. Teams may fine tune their vehicles and resubmit for Qualification. There is no penalty for not qualifying the first time. Vehicles that are judged to be unsafe will not be allowed to compete. In the event of any conflict, the judges' decision will be final.

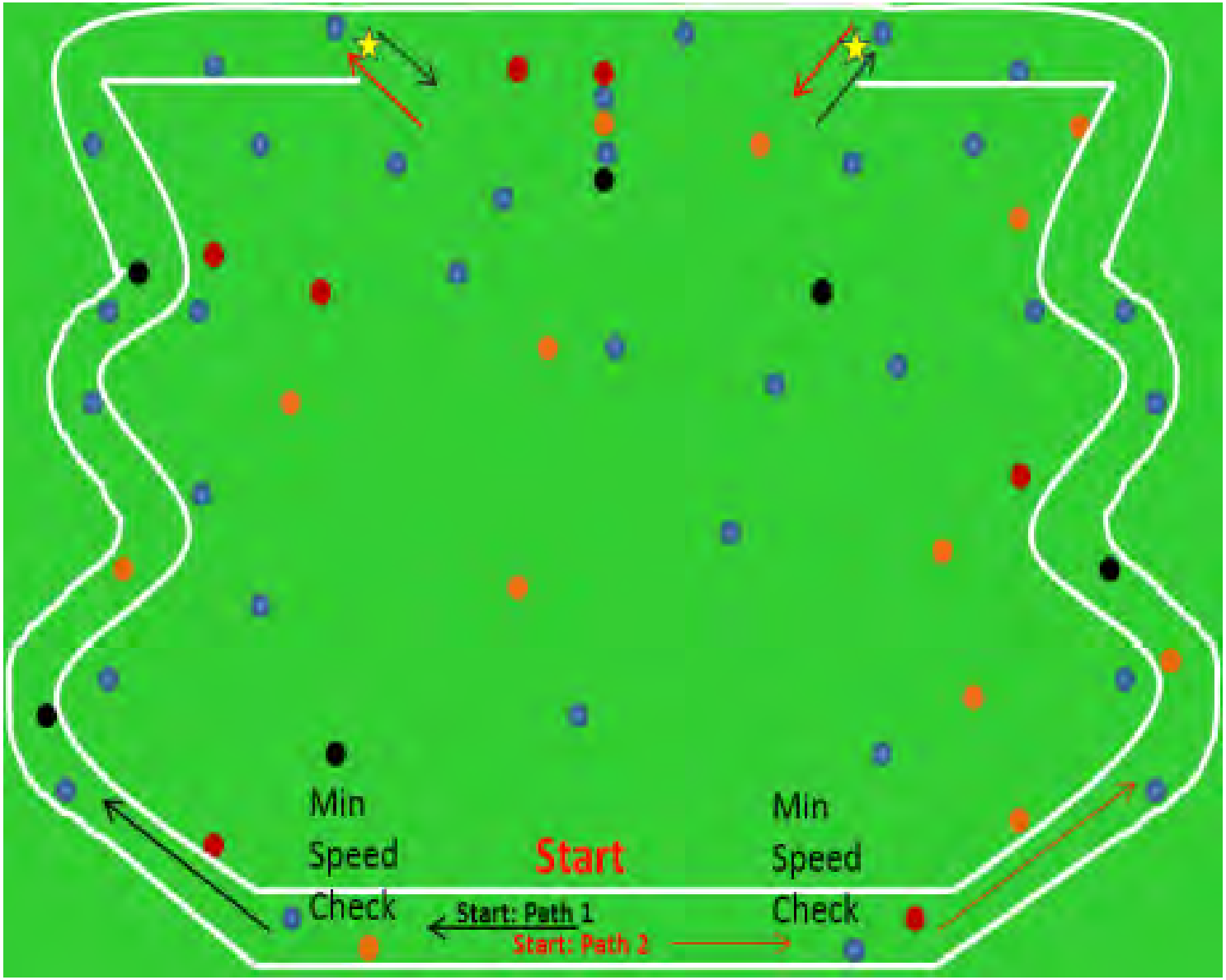
Auto-Nav Challenge

A fully autonomous unmanned ground robotic vehicle must negotiate around an outdoor obstacle course under a prescribed time while maintaining a minimum of speed of one mph over a section and a maximum speed limit of ten mph, remaining within the lane, negotiating flags and avoiding the obstacles on the course.

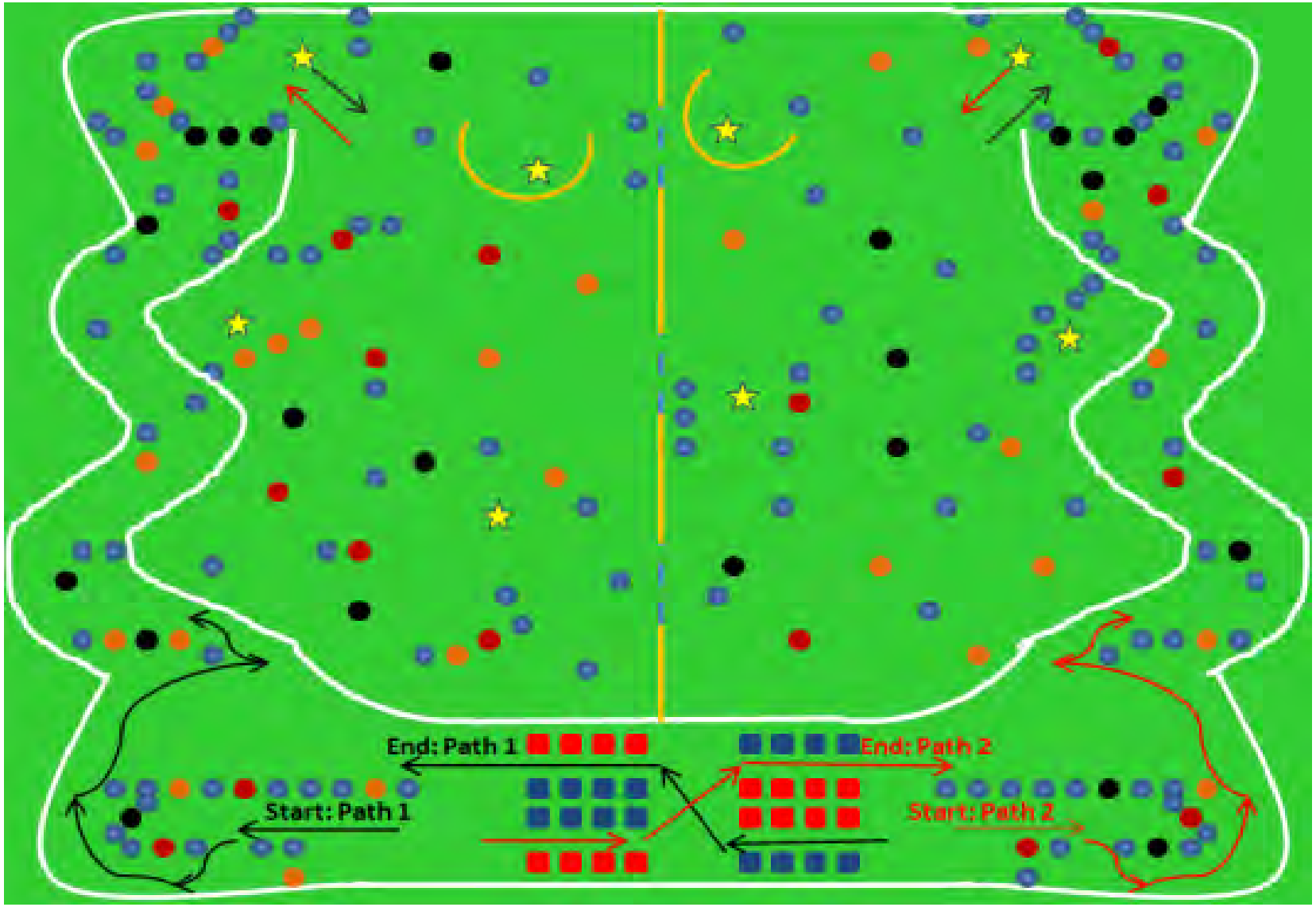
Judges will rank the entries that complete the course based on shortest adjusted time taken. In the event that a vehicle does not finish the course, the judges will rank the entry based on longest adjusted distance traveled. Adjusted time and distance are the net scores given by judges after taking penalties, incurred from obstacle collisions and boundary crossings, into consideration.

AWARD MONEY:
$ 25,000

Basic Auto Nav Course



Advanced Auto Nav Course



2015 Auto-Nav Challenge Results
Basic Course

Place	School	Team	Distance	Waypoints	Time
1	University of New South Wales	Pepper	510	6	1:27
2	California State University-Northridge	El Toro	510	6	1:58
3	Oakland University	Mantis	510	6	2:34
4	University of Michigan-Dearborn	OHM 3.0	510	2	3:26
5	United States Naval Academy	Robogoat	510	0	3:33
6	Ecole de Technologie Superieure	CAPRA6	510	0	4:28
7	Lawrence Technological University	Bigfoot	510	0	5:00
8	Embry-Riddle Aeronautical University	Zero2	430		5:00
9	Trinity College	Q	290		5:00
10	Hosei University	Orange2015	284		4:11
11	Université de Moncton	Break Point	157		2:45
12	University of Detroit Mercy	Thor Pro	85		1:36
13	Bluefield State College	Apollo	60		0:19

2015 Auto-Nav Challenge Results
Advanced Course

Place	School	Team	Distance	Waypoints	Time
1	University of New South Wales	Pepper	1032	6	3:52
2	California State University-Northridge	El Toro	1032	6	10:00
3	University of Michigan-Dearborn	OHM 3.0	756	6	6:46
4	United States Naval Academy	Robogoat	633	2	8:55
5	Ecole de Technologie Superieure	CAPRA6	172	0	5:59
6	Oakland University	Mantis	166	0	1:47
7	Lawrence Technological University	Bigfoot	161	0	1:19

Design Competition

Although the ability of the vehicles to negotiate the competition courses is the ultimate measure of product quality, the officials are also interested in the design strategy and process that engineering teams follow to produce their vehicles. Design judging will be by a panel of expert judges and will be conducted separate from and without regard to vehicle performance on the test course. Judging will be based on a written report, an oral presentation and examination of the vehicle.

Design innovation is a primary objective of this competition. Two forms of innovation will be judged: First will be a technology (hardware or software) that is new to this competition; and Second will be a substantial subsystem or software upgrade to a vehicle previously entered in the competition. In both cases the innovation needs to be documented, as an innovation, clearly in the written report and emphasized in the oral presentation. Either, or both, forms of innovation will be included in the judges' consideration.

AWARD MONEY:
$ 3,000

2015 Design Competition Results

Design Finalist			
Place	School	Team	Score
1	Embry-Riddle Aeronautical University	Zero2	432.22
2	Oakland University	Mantis	408.11
3	École de technologie supérieure	CAPRA6	402.78
4	University of British Columbia	Snowflake	394.78
5	Bluefield State College	Apollo	393.44
6	Hosei University	Orange2015	388.44

Design results for Group A, Group B and Group C can be found in the paper or on the website.

IOP Challenge

The Interoperability Profile (IOP) Challenge verifies that teams are using a standardized message suitable for controlling all types of unmanned systems, and is the SAE-AS4 unmanned systems standard, commonly known as JAUS. Teams that completed the challenge will send a request for identification to the Common Operating Picture (COP) once every 5 seconds. The COP will respond with the appropriate informative message and request identification in return from the team's JAUS interface. After the identification report from the COP, the team entry will stop repeating the request. This transaction will serve as the discovery between the OCU via an RF data link and the vehicle. The vehicle that travels the farthest on the course, or completes the course in the shortest time wins.

AWARD MONEY:
$ 3,000

2015 IOP Challenge Results

Place	School	Team	Points
1	California State University - Northridge	El Toro	24
2	Lawrence Technological University	Bigfoot	20
3	Trinity College	Q	16
4	University of New South Wales	Pepper	12
5	University of British Columbia	Snowflake	4
6	Hosei University	Orange2015	4

Rookie-of-the-Year

The Rookie-of-the-Year Award will be given out to a team from a new school competing for the first time ever or a school that has not participated in the last five competitions. To win the Rookie-of-the-Year Award the team must be the best of the eligible teams competing and perform to the minimum standards of the following events. In the Design Competition you must pass Qualification, in the AUTO-NAV Challenge you must pass the Rookie Barrel.

AWARD MONEY:
$1,000

Grand Award

The Grand Award is given to the team with the best overall performance **in all three events. The Grand Award trophies will be, presented to the top three teams that perform the best overall (combined scores per below), in all three competitions. For each competition, points will be awarded to each team, below is a breakdown of the points:**

AWARDS:
LESCOE CUP
LESCOE TROPHY
LESCOE AWARD

2015 Grand Award Results

Place	School	Team	Total
1	California State University - Northridge	El Toro	64
2	University of New South Wales	Pepper	60
3	École de technologie supérieure	CAPRA6	24
3	Embry-Riddle Aeronautical University	Zero2	24
3	Oakland University	Mantis	24
6	Lawrence Technological University	Bigfoot	20
7	University of Michigan-Dearborn	OHM 3.0	16
7	Trinity College	Q	16
9	United States Naval Academy	RoboGoat	12
10	University of British Columbia	Snowflake	10
11	Bluefield State College	Apollo	8
11	Hosei University	Orange2015	8

Questions?

WWW.IGVC.ORG

ACM Overview

Andrew Smart CTO

Michigan Connected and Automated Vehicle Working Group

June 3, 2016

Connected & Automated Vehicles

- Connected and Automated Vehicle (CAV) technology will revolutionize transportation
  - can increase safety and mobility, and decrease energy use
- Significant technical and policy challenges remain to be solved
  - including standards, methods for safe testing, validation, and verification
- A combination of simulation, track testing, and on-road testing will be required

CAV Research & Product Development Needs

- **Accelerated development of voluntary standards**
- **Accelerated product development** & validation of CAV technology
- **Verification and self-certification** of CAV technology
- Development, testing, & validation of **V2I and I2I** applications & standards
- Research, testing & product development for:
  - Crash avoidance & automation technology at high speeds and in urban environments
  - Automated operation on off-road, degraded, and unimproved surfaces
  - V2X communication, including infrastructure and hand-held devices
  - DSRC device communication protocol and interfaces
  - Cybersecurity measures and validation testing
  - Automated freight, trucking and transit of materials
  - Ground truth testing of automated vehicle safety technologies
  - In-use monitoring of vehicles/devices in the field
  - Internationally harmonized standards

ACM - American Center for Mobility

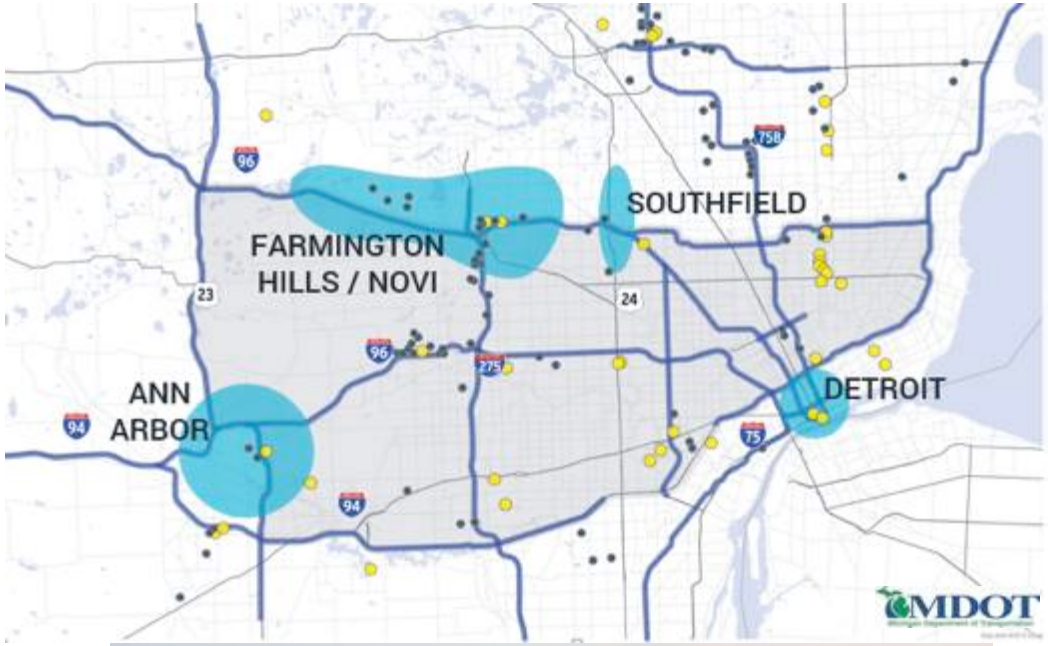
A non-profit connected and automated vehicle testing and product development facility, designed to accelerate the development of voluntary standards and technology deployment

Other 'auto' countries are building facilities

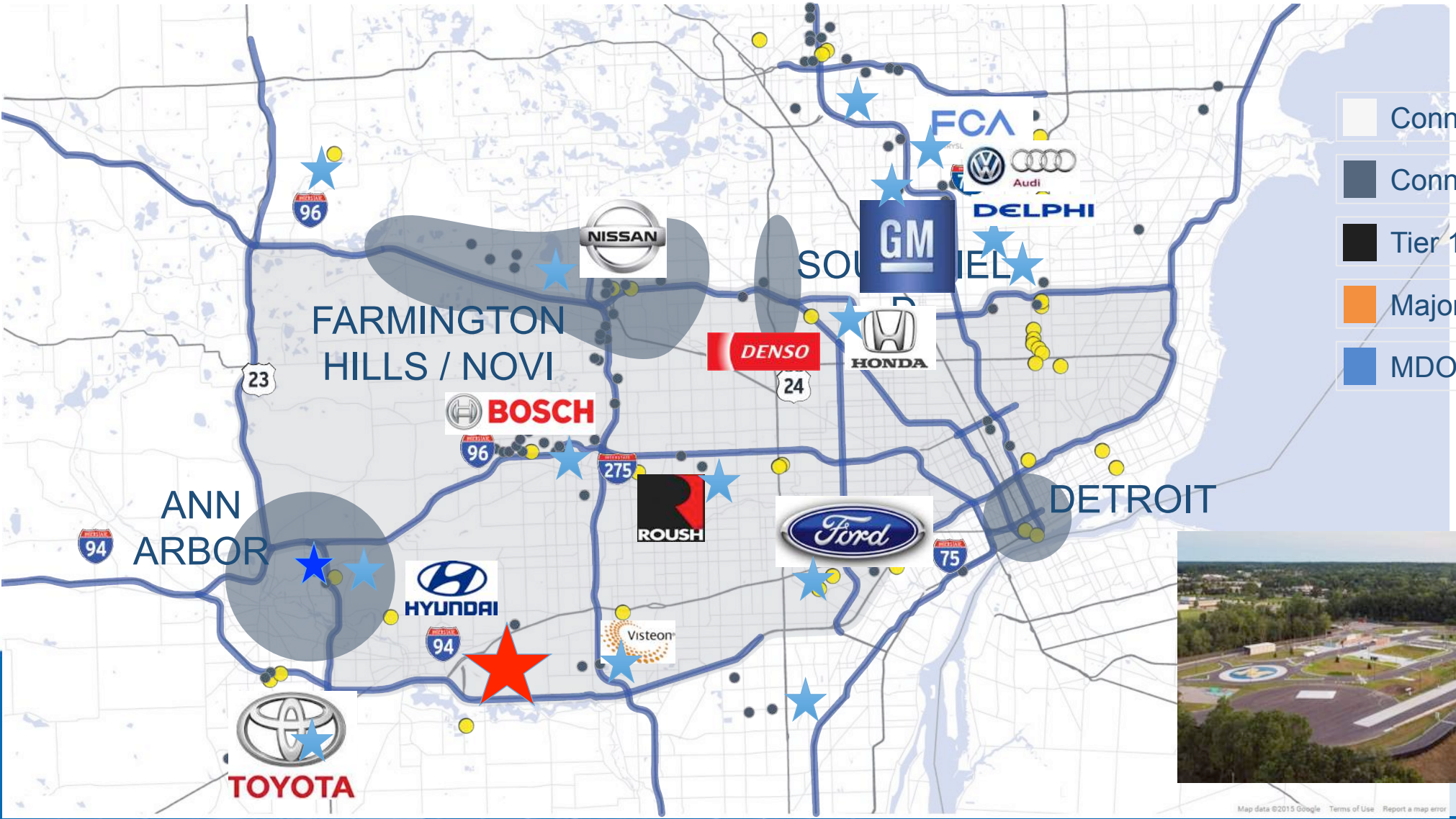
Why Michigan?

- Greatest concentration of the auto industry in the world
- Adjacent to university mobility initiatives
- Integrated with a forward-looking state DOT and government
- Unique site with both iconic and tangible qualities
  - Surrounded by connected infrastructure
  - Home of the Arsenal of Democracy
  - Co-located with commercial airport to facilitate travel
- More mobility-related assets than any other region

✪ MDOT Facilities ★ LC Member HQ or Key Facility



Why Michigan?



- Connected Vehicle Environment
- Connected Vehicle Test Beds
- Tier 1 Automotive Suppliers
- Major OEM Facilities
- MDOT Roadway ITS Coverage

MEDC
MICHIGAN ECONOMIC DEVELOPMENT CORPORATION

UNIVERSITY OF MICHIGAN

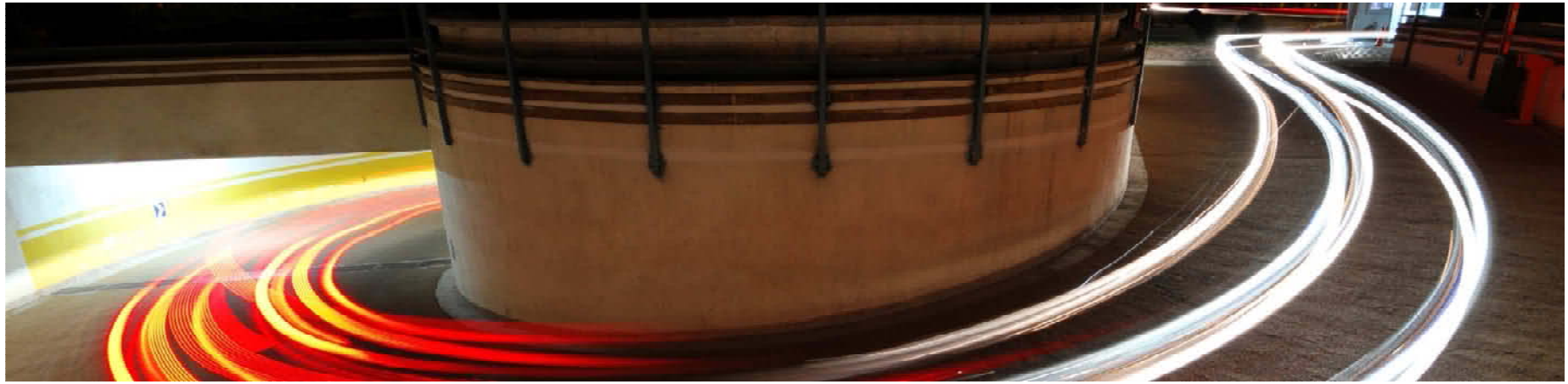
MDOT
Michigan Department of Transportation

Thank You

BUSINESS LEADERS FOR MICHIGAN

ytown.org
CHARTER TOWNSHIP OF YPSILANTI
Charter Township of Ypsilanti

SPARK@nn arbor usa



From Park Assist to Automated Driving

Intuitive Driving

Valet Park4U®

Amine Taleb

Manager – Advanced Projects

Comfort & Driving Asssistance Systems

Valeo North America, Inc.

June 2016

Park Assist Evolution – Birth of Park4U®

1991

Ultrasonic

PARK ASSIST

2007

SYSTEM EVOLUTION

Park4U®

SEMI-AUTOMATIC PARKING

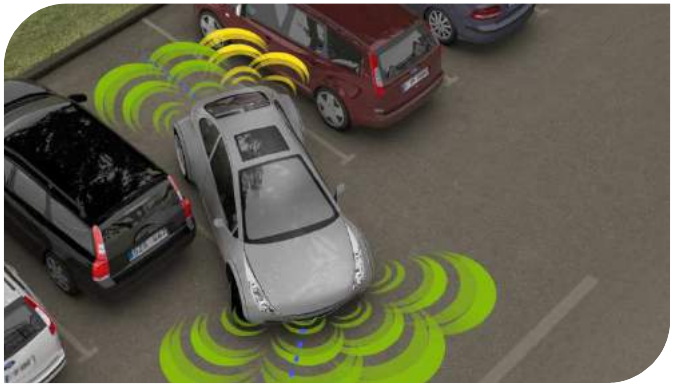
Park Assist Evolution – Enhanced Park4U®

2010

Park4U® 2.0

PERPENDICULAR PARKING

ACTIVE BRAKING



2011

FlankGuard

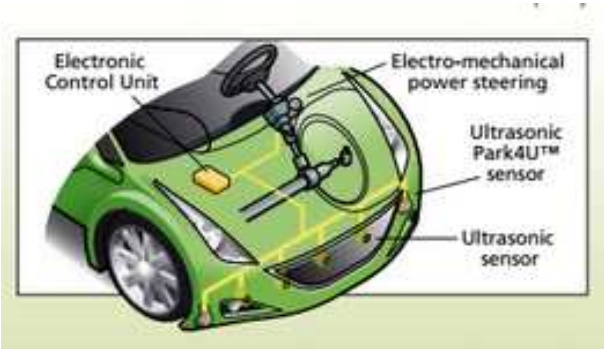
360° PARK ASSIST

Park Assist Evolution – Automated Parking

2013

Auto Park4U®

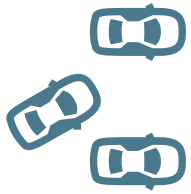
FULLY-AUTOMATIC PARKING



2014

Park4U® 3.0

FORWARD PARKING



Park Assist Evolution – Next Gen Park4U®

Garage Park4U®

TRAINED PARKING

2016

Park4U® Remote

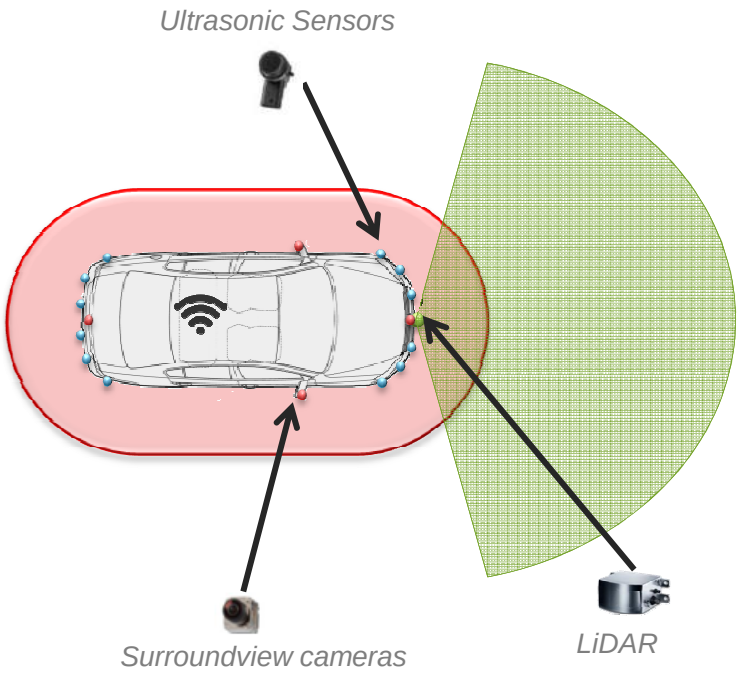
SENSOR FUSION

DRIVER OUTSIDE

Valet Park4U®

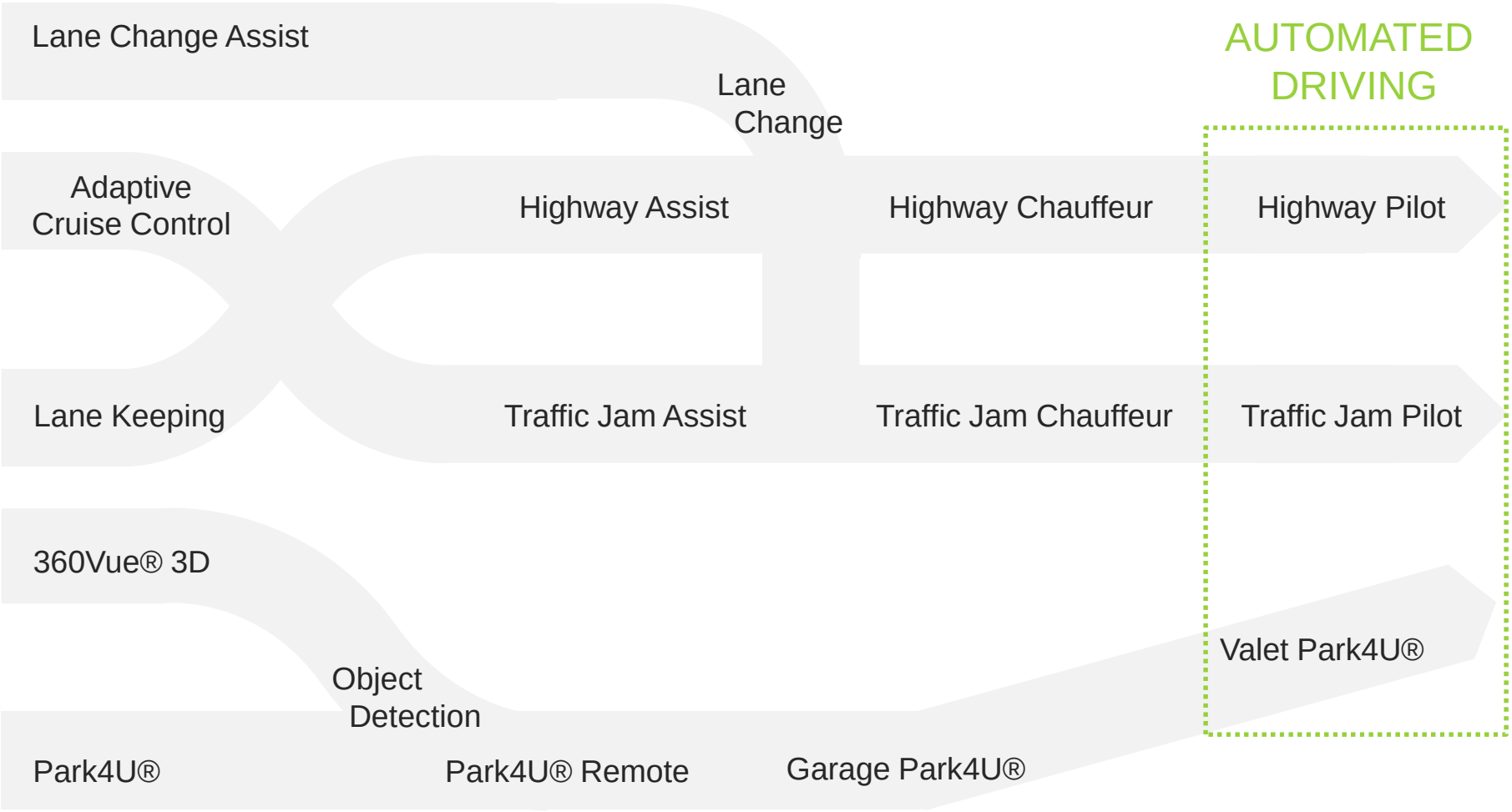
SPECIFIC PARKING AREAS

Valet Park4U® Concept – The Self-Parking Car



Merging Parking and Driving Automation

The Road Towards Automated Driving



The Road Towards Automated Driving

Drive4U

Valeo

Automotive technology, naturally

SAE INTERNATIONAL®

2016 SAE BATTELLE CYBERAUTO CHALLENGE

July 25-29, 2016 Warren, Michigan

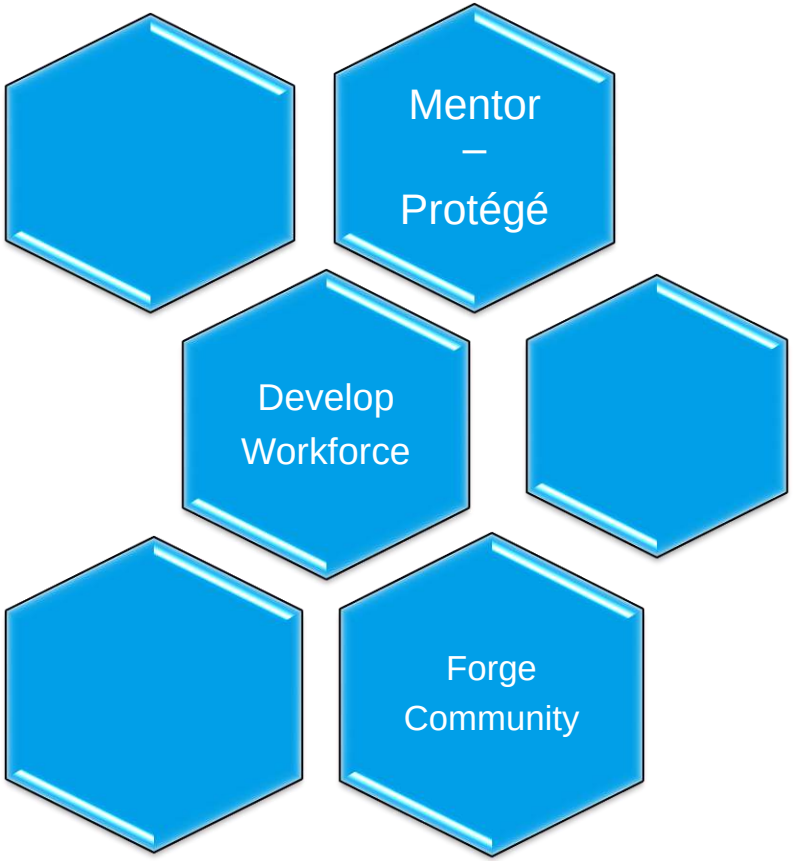
http://www.sae.org/events/cyberauto/

P151498

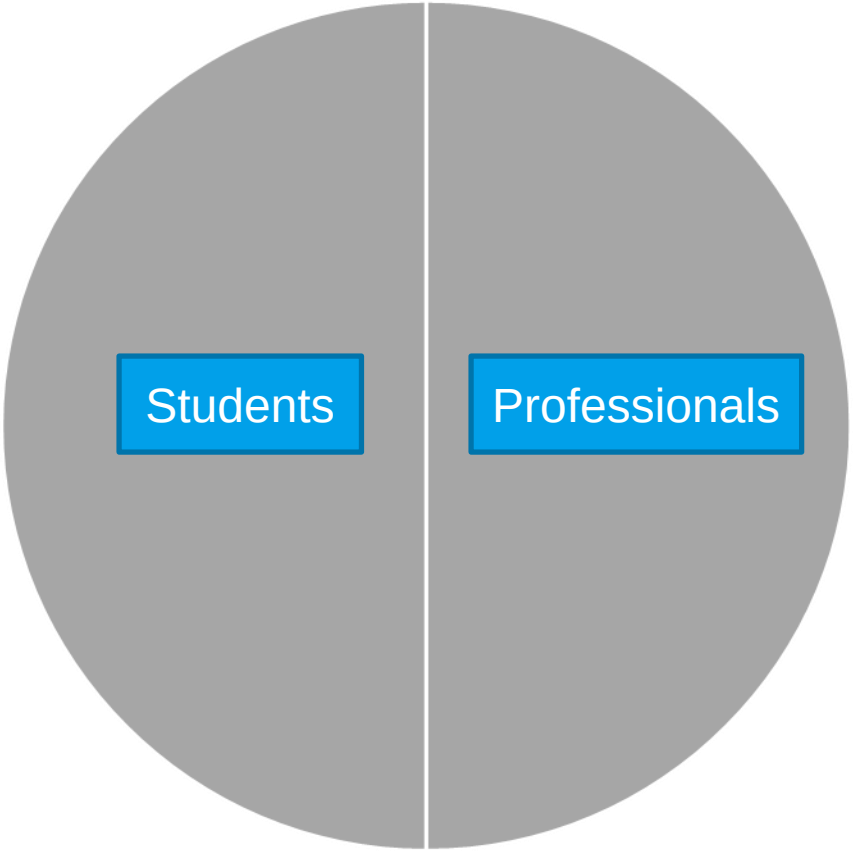
What is the CyberAuto Challenge

- **Practicum-based learning environment**
- **Immersive**
- **STEM education program**
- **Real cars, real tools, real engineers, real hackers**
- **Intended exemplar for educational programs**
- **Technical “inn at the crossroads” for the automotive industry**
- **Unabashedly pro industry (safe zone)**

Purpose



Cohorts



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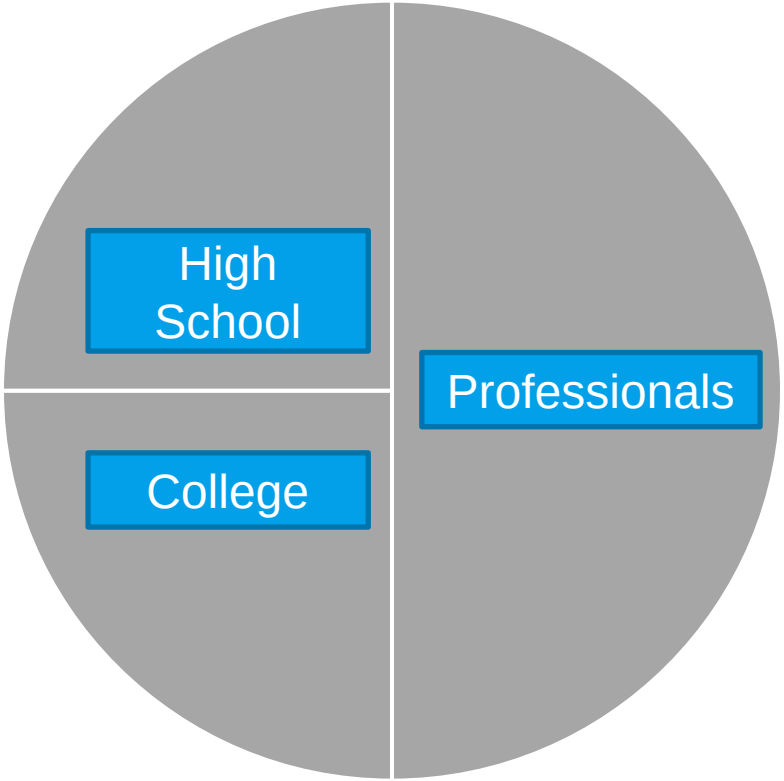

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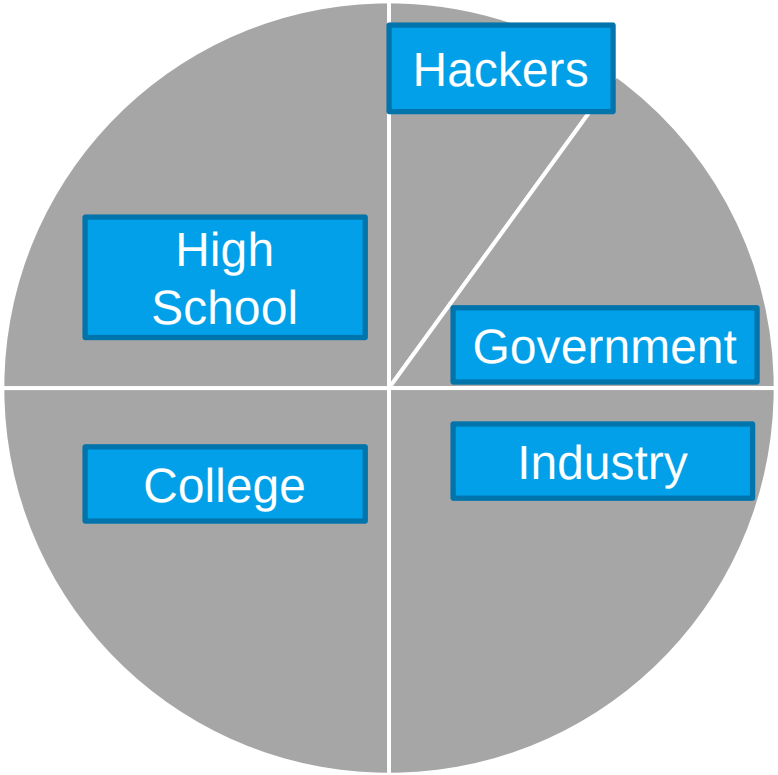
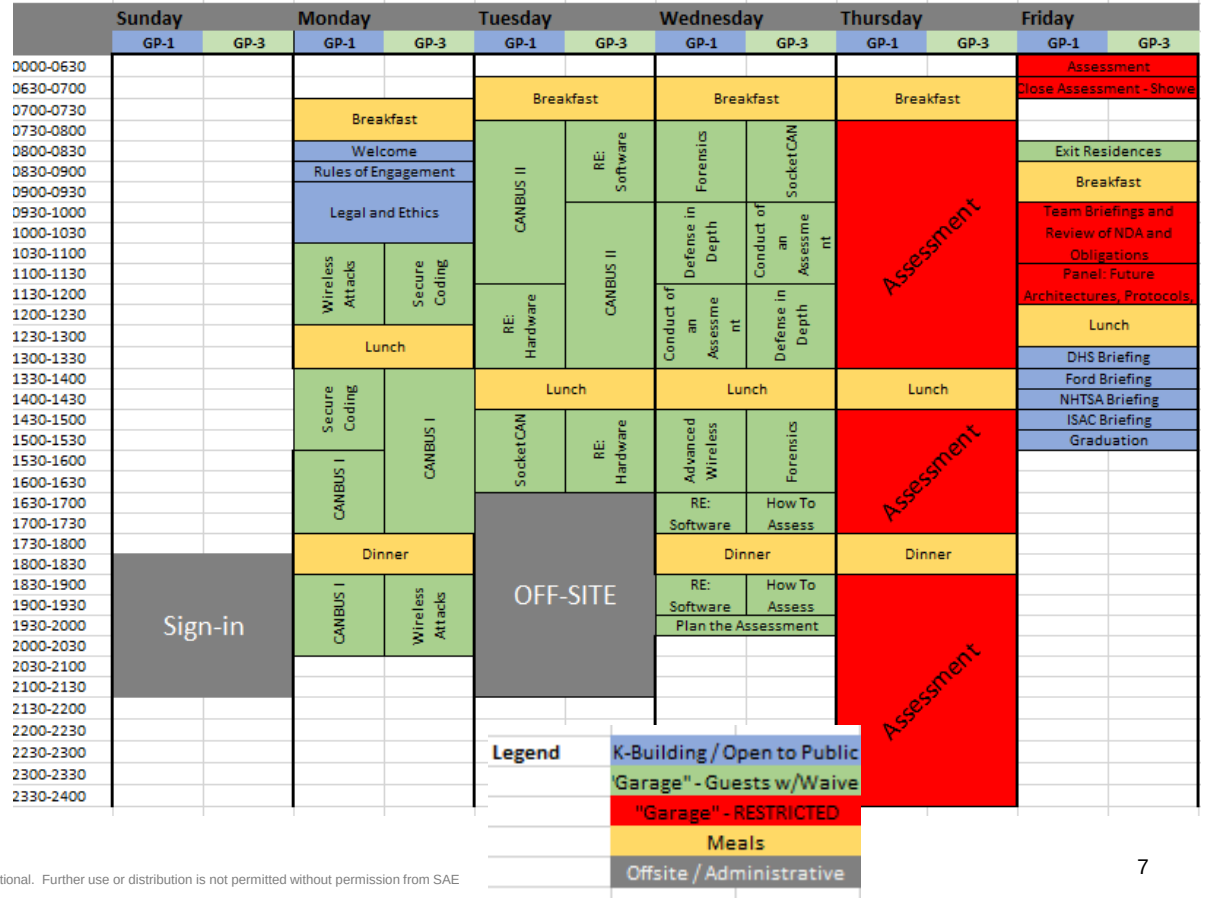


Preliminary Challenge week schedule

Immersive in Nature

- Maximize group interactions
- Focus on collaborative teaching & engagement
- Provide basic instruction with continuous facilitation

– Sunday arrival
– Mon thru Wed series of lessons alternating with hands-on work
– Tuesday off-site tour / networking event
– Thurs 24 hr. Challenge “hackathon”
– Friday graduation



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Keynotes and themes

- 2012 – APG – Len LaPadula - Resiliency
- 2013 – OSU CAR – Jim Christy – CyberCrime
- 2014 – Delphi - Bruce Schneier - Privacy
- 2015 – Delphi – David Strickland – Landscape Changes
- 2016 – Mccomb CC – Mudge – IoT Cybersecurity

Value Proposition

- Awareness of relevant automotive cybersecurity issues
  - Increased vehicle electrical/electronic system complexity
  - Increased number of interfaces – wireless and wired
- Cooperative relationship building
  - Collaboration among students, industry, gov't, academia fostering mentor – protégé relationships
- Workforce development
  - Exposing high school and college students to high tech careers in auto industry
  - Improving current auto engineer cybersecurity skills and knowledge
  - Intern / employee recruitment opportunity

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Benefits for students

- Develop foundational understanding of security approaches
- Learn about unique automotive cyber issues
- Increase technical skills; particularly in CAN protocols and programming
- Put theory to practical use
- Develop initial project management skills; experiencing time constraints and limited resources
- Team with working engineers and researchers in a professional environment
- Develop relationships with professionals and other students….now they are a part of a “community of interest” – the auto cyber community!
- Participate in a unique event aimed at developing a new discipline for the automotive industry

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Benefits for professional team members

- Develop and deepen peer to peer relationships with automotive engineers (OEM and supplier), researchers and government representatives
- Raise awareness among students of the highly technical nature of automotive jobs; igniting interest in automotive careers
- Actively develop the future talent pipeline in cybersecurity, ensuring a well-trained and educated workforce for the automotive industry
- Develop mentor-protégé relationships with students
- Directly assess student capabilities for potential job recruitment
- Developed a germ of cyber auto “community of interest” for the future

History

- Motivated by the progress in embedded technologies in automobiles & increased connections – cellular, WIFI, Bluetooth, OnStar, DSRC, Satellite radio, etc.
- Need for a tailored curriculum to support cybersecurity auto issues; portions of electrical engineering, mechanical engineering and computer science plus other professions
- 2012 created by Battelle and the Founder of Center for Advanced Vehicle Environments (CAVE) Karl Heimer, now co-founder of AutoImmune
- 2015 SAE International leadership and administration

Aug 2012 Aberdeen Proving Grounds (Maryland)
July 2013 Ohio State University Center for Automotive Research (Columbus, Ohio)
July 2014 Delphi Headquarters, Troy MI (Detroit Metropolitan area)
July 2015 Delphi Headquarters, Troy, MI (Detroit Metropolitan area)

- 192 attendees -- 30+ students, 30+ professionals from OEMs, auto suppliers, government agencies (DoD, DoT), 5 “white hat” hackers, 5 STEM educators, plus visits by several automotive management leaders, e.g. Security Directors

July 25-29, 2016: Macomb Community College, Warren MI

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Contact Information

Patti Kreh – patti.kreh@sae.org	**Program Executive / sponsorships, student outreach, corporate outreach**
Marc LaDuc – marc.laduc@sae.org	**Program owner / Logistics**
Karl Heimer – karl.heimer@autoimmune.io	**Content, curriculum, theme professional outreach**

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2016 SAE BATTELLE CYBERAUTO CHALLENGE

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Continental
The Future in Motion

Senses for Safety.
Driver assistance systems help save lives.

Continental – Oakland University Joint Project

Project Review

June 3, 2016

Agenda

- Project Bacground
- Current Project Objective
- Future Project Objective
- Team Overview
- Vehicle Build
- Budget & Contributions

SensePlanAct

Project Background

- Oakland University Hosts the one and only IGVC competition WW

- Some 40+ Universities all over the world compete

- Typically the platforms utilized are not street legal and they are slow

Spec2

"Spec1"
est. 1992

- Vehicle

-FMVSS-500 / EU Quadricycle (street legal)

-Roadway Track Setting, up to 25 mph

Why?

- Relevance to auto transportation
- Expect broader sponsorship interest
- Large space to create challenges

When & Where?

- Rochester Hills, Michigan
- During IGVC "Spec1"
- "Third Ring" along with Spec1 "Basic" & "Advanced"

SensePlanAct

Project Background

Modeled after IGVC but w/ roadway scenarios & conditions

Vehicle Platform:

Standard FMVSS 500 Vehicle (Gem e2)

Drive by-wire

Sensors (Radar, Camera, GPS, IMU...)

Connectivity via wi-fi and cellular

Teams to Develop:

Integration by-wire controls

Integrated motion control

Integrated Automotive Sensors

Sensor fusion

Vision / Detection SW

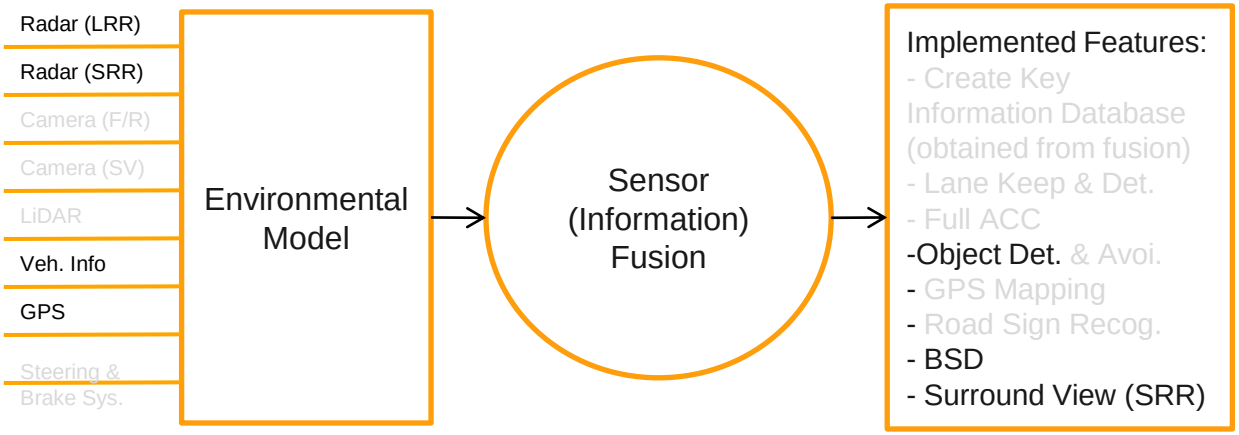
Driving control SW (lane keeping, gap keeping...)

Decision and navigation AI

SensePlanAct

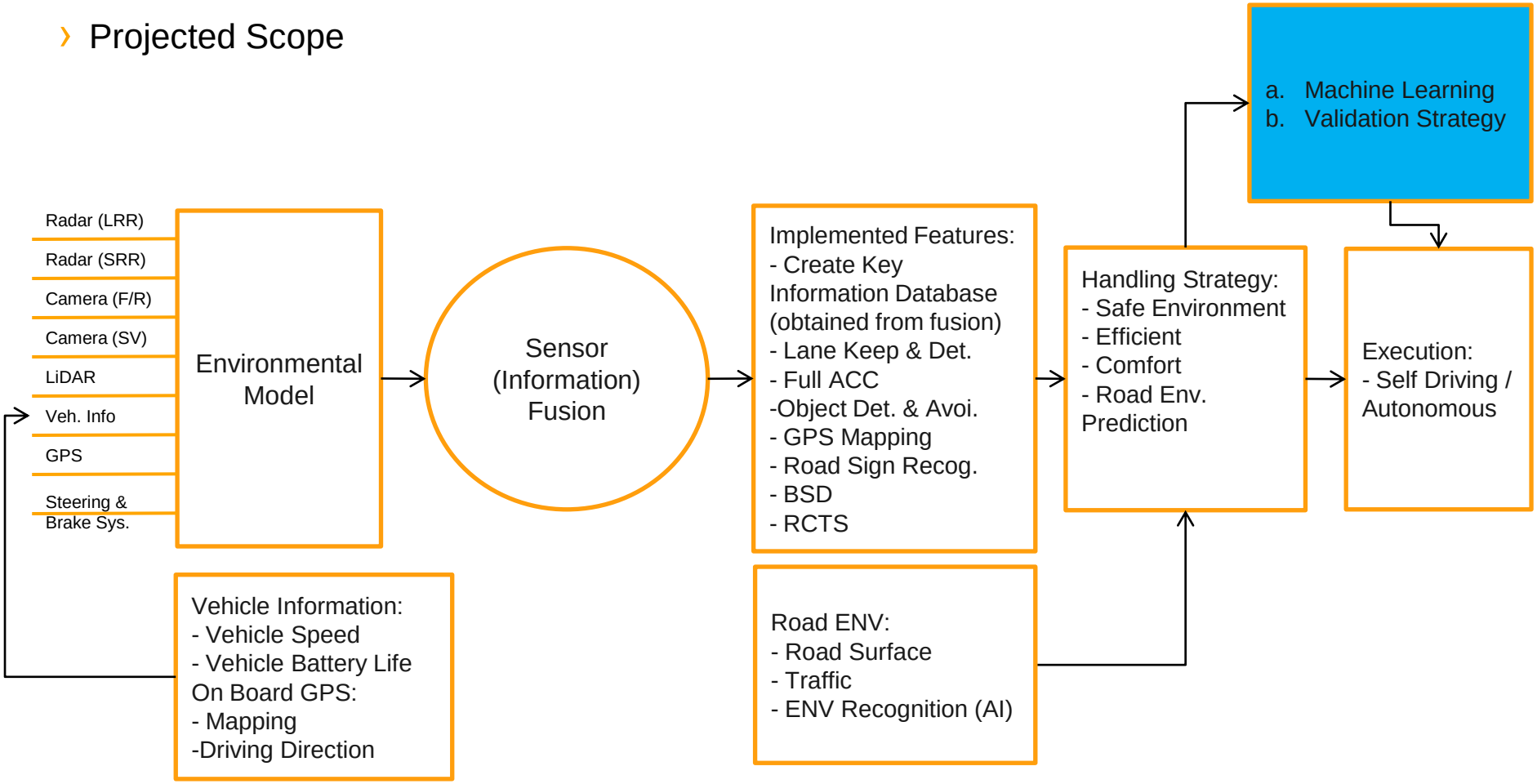
Project Scope and Definition for June/2016

› Projected Scope



Project Scope and Definition for June/2017

› Projected Scope



SensePlanAct

Team Overview

- Project team is made of Continental Employees from various BU's that are involved in different levels of education within OU.
- PhD Thesis & Project Lead:
  - Irfan Baftiu (ADAS)
- Project Team Members (Currently):
  - Gentian Godo (AE- ADAS) – Graduate Level
  - Peter LeVasseur (AE- ADAS) – Graduate Level
  - Noah Gedrimas (SNT) – Graduate Level
  - Peter Southerland (T&V – ADAS) – Graduate Level
  - Kyle Carpenter (SNT) – Graduate Level
  - Ganesh Adireddy (SNT) – Graduate Level
  - Nilsi Godo (T&V – ADAS) – Undergrad Level
  - Viljo Wagner (T&V – ADAS) – Undergrad Level
  - Fady Hanna (T&V – ADAS) – Undergrad Level
  - Nashwan Marcos (T&V – ADAS) – Undergrad Level

SensePlanAct

Sensor Mounting Design – Requirements

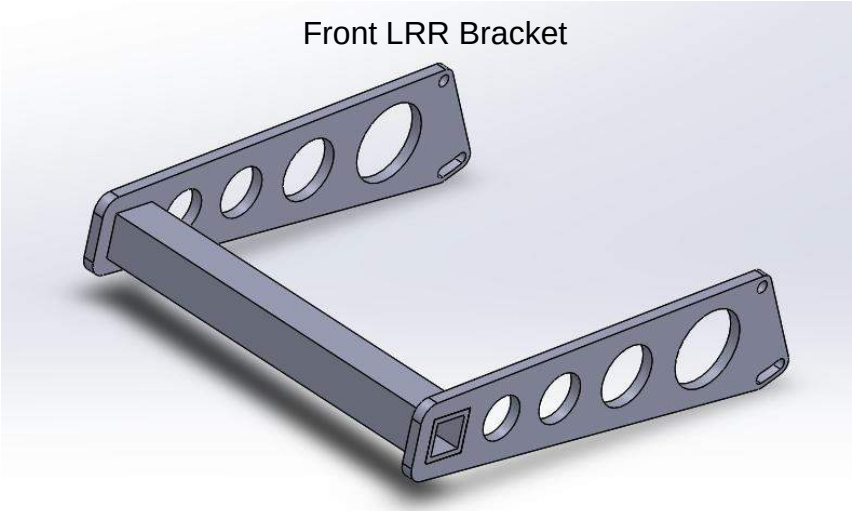
- Manufacturability
  - Brackets need to be easy to make and mass producible
- Accuracy for modularity
  - Brackets need to be located accurately using existing holes in frame
- Stiffness
  - Brackets need to be adequately stiff Target of 55Hz natural frequency
- Cost
  - Brackets need to be cheap to manufacture

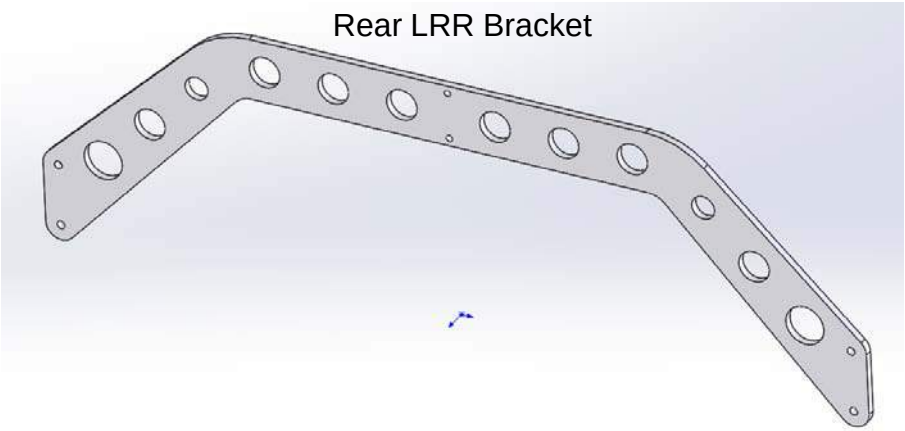
Sensor Mounting – Design

- All brackets are made from 6061 T6 Aluminum out of ¼” plate and 1” 0.125” wall box tubing
- Brackets were cut using a water jet and welded with a TIG
- Parts were sand blasted and spray painted by a third party
- Brackets bolt to the frame and to the adjustable azimuth angle brackets provided by Continental

Sensor Mounting Design – Long Range Radar (LRR)

- Front LRR bracket was designed to mount to existing chassis bolts, thus eliminating the need to modify the vehicle.



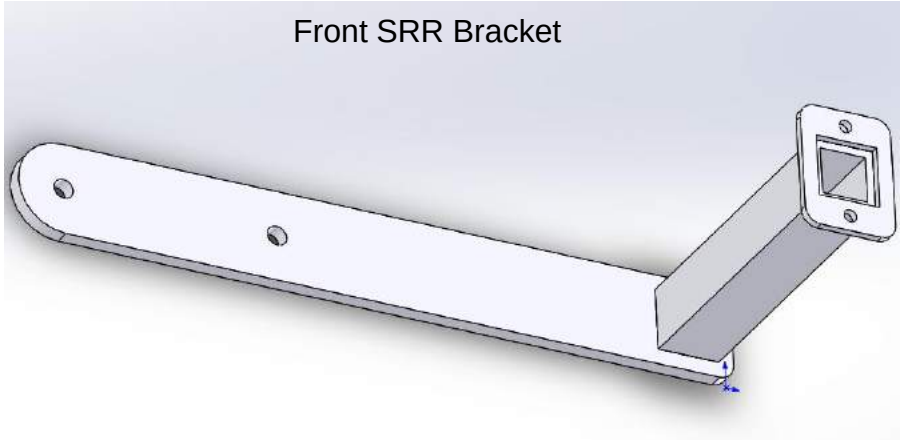


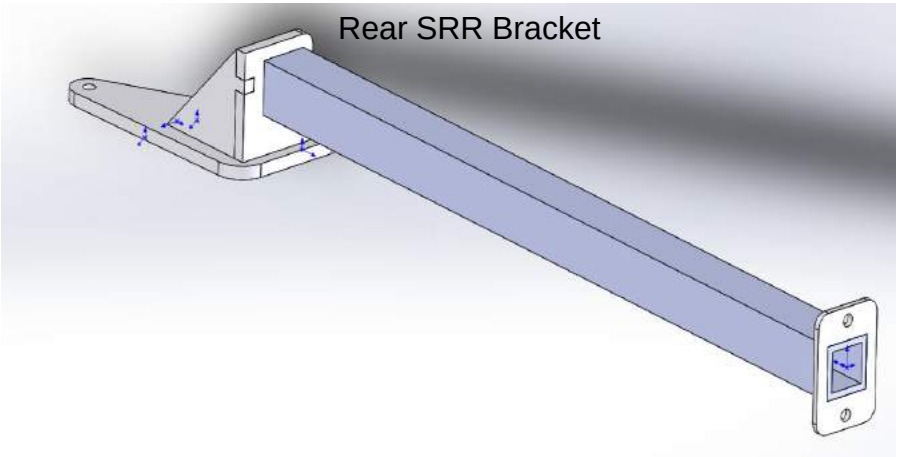
- Rear LRR bracket were similarly designed to mount to existing chassis bolts, thus eliminating the need to modify the vehicle.
- Overall intent was to design brackets which would not drive any body or chassis modification.

SensePlanAct

Sensor Mounting Design – Short Range Radar (SRR)

- Front SRR bracket was designed to mount to existing chassis bolts, thus eliminating the need to modify the vehicle.





- Rear SRR bracket were similarly designed to mount to existing chassis bolts, thus eliminating the need to modify the vehicle.
- Overall intent was to design brackets which would not drive any body or chassis modification.

Q&A