

Introduction of China C-V2X Industry

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China Industry Innovation Alliance for the Intelligent and Connected Vehicles(CAICV)
China Society of Automotive Engineers (China-SAE)



Contents

1

Introduction of CSAE and CAICV

2

China C-V2X Industry

3

CSAE/CAICV Working Progress in 2021

4

CSAE/CAICV Working Plan in 2022

CSAE

- **China Society of Automotive Engineers** (China-SAE or CSAE), a national academic organization, was founded in **1963**, the secretariat is set up in Beijing.
- **CSAE** main services include academic communication, automotive policy research, collaborative innovation, talent training and technical standards establishment.

Full-time Staff

员工

176

Registered members:

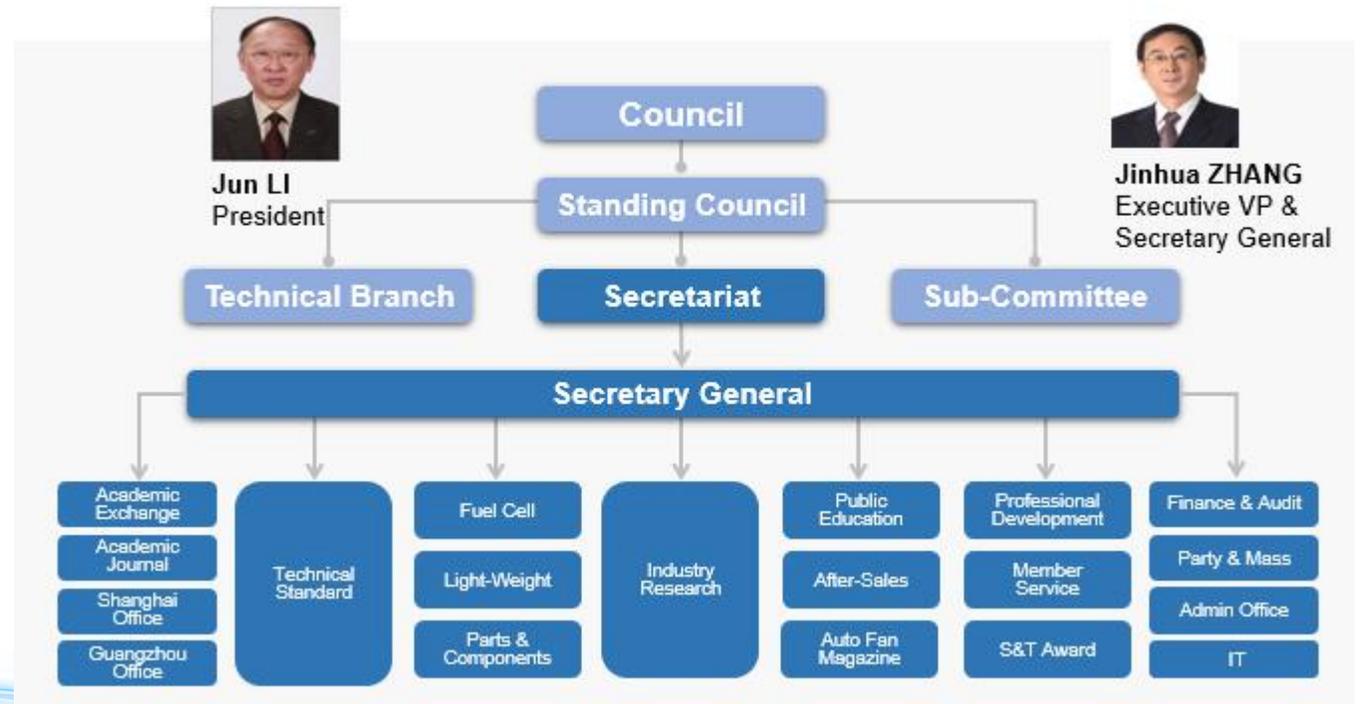
注册会员

120000+

Unit members:

单位会员

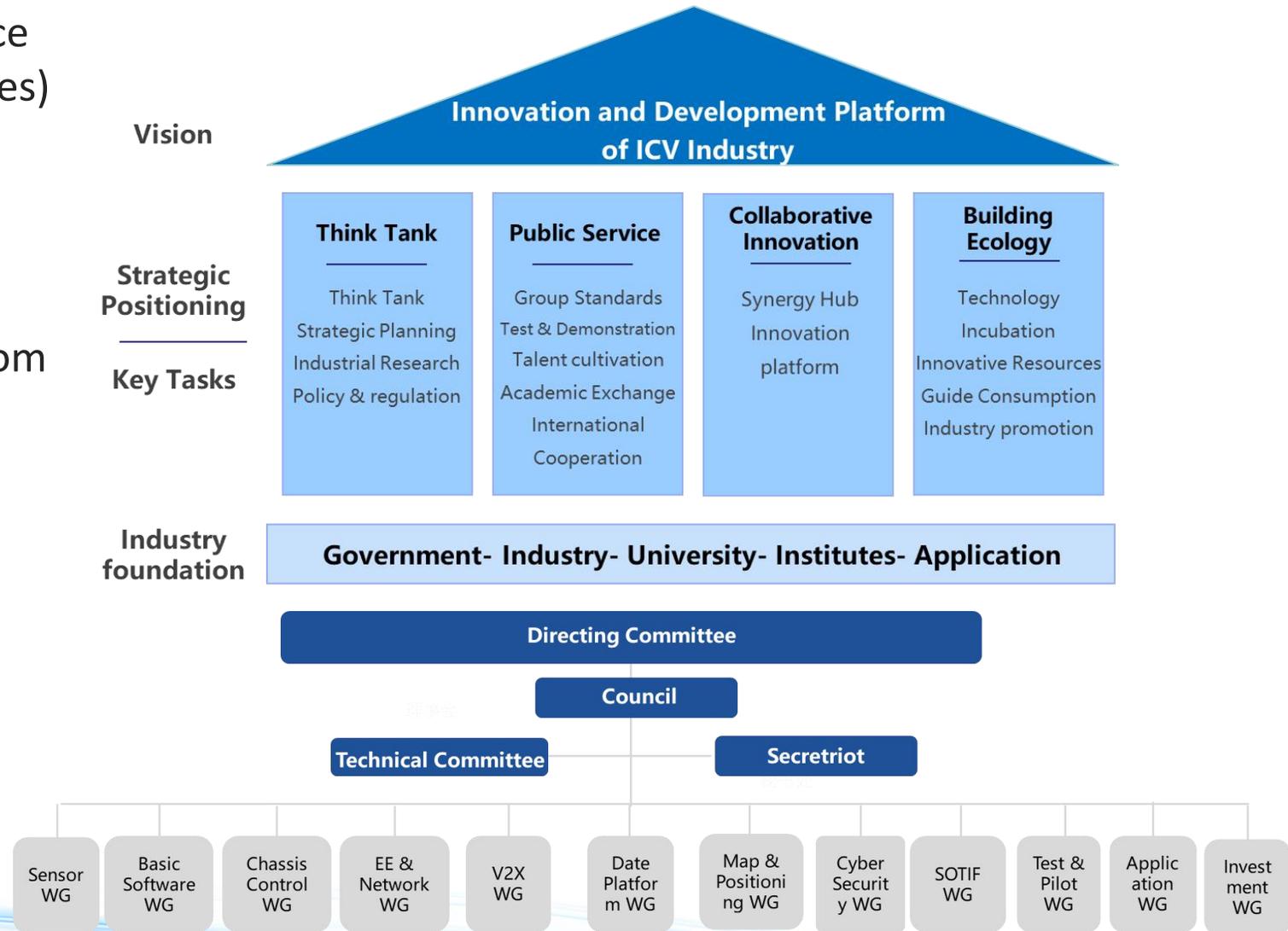
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CAICV

CAICV (China Industry Innovation Alliance for the Intelligent and Connected Vehicles)

- Established in 2017
- Supported by MIIT
- Over 500 members, including companies, universities, institutes from automotive, telecommunication, transportation and electronics industries
- 12 working groups for different technical fields



Contents

1

Introduction of CSAE and CAICV

2

China C-V2X Industry

3

CSAE/CAICV Working Progress in 2021

4

CSAE/CAICV Working Plan in 2022

ICV Incentive Policies

"Intelligent Vehicle Innovation and Development Strategy"(2020.02)

By 2025, the **vehicle wireless communication network (LTE-V2X)** will achieve regional coverage. **5G-V2X will be gradually applied in some cities and highways.**



National Development and Reform Commission

"Notice on Promoting 5G Accelerated Development" (2020.03)

Promote the coordinated development of "**5G + Internet of Vehicles (IoV)**". Integrate IoV into national new information infrastructure construction projects and promote **LTE-V2X scaling deployment.**



Ministry of Industry and Information Technology of the People's Republic of China (MIIT)

"New Energy Vehicle (NEV) Industry Development Plan (2021-2035) "(2020.10)

Promote the construction of **intelligent road network facilities**. Promote the construction of the new generation of wireless communication networks, and accelerate the development of **C-V2X standards and technology innovation.**



State Council of the People's Republic of China

"New Energy Vehicle (NEV) Industry Development Plan (2021-2035) "(2020.10)

Promote the construction of intelligent road network facilities. Promote the construction of the new generation of wireless communication networks, and accelerate the development of C-V2X standards and technology innovation.



State Council of the People's Republic of China

"Notice on Organizing Pilot Work for the Coordinated Development of Smart City Infrastructure and Intelligent Connected Vehicles" (2021.12)

Two ministries determined six cities **including Beijing, Shanghai, Guangzhou, Wuhan, Changsha, and Wuxi** were the first batch of pilot cities. 10 cities including **Chongqing, Shenzhen, Xiamen, Nanjing, Jinan, Chengdu, Hefei, Cangzhou, Wuhu, and Zibo** are the second batch of pilot cities.



Ministry of Industry and Information Technology of the People's Republic of China
Ministry of Housing and Urban-Rural Development of the People's Republic of China

LTE-V2X Standard System

China's C-V2X standard system has been initially formed. Standards have covered core technologies in the **access layer, network layer, message layer, and security layer.**



4 committees signed “C-V2X Standards Cooperation Framework”



CAICV signed MoU with CCSA, C-ITS, TIAA to promote ICV cross-industry standard synergy

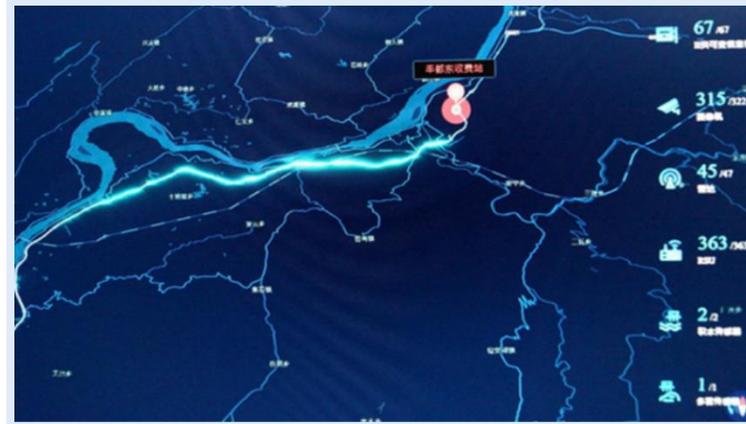
Category	Standards Name	Standards	State
Access layer	General Technic Requirements for LTE-based Vehicular Communication	GB	PWI
	Technic Requirements of Air Interface for LTE-based Vehicular Communication	GB	PWI
Network layer	Cooperative intelligent transportation system—Vehicular communication application layer specification and data exchange standard	Group	Publish
	LTE-based vehicular communication--Technic requirements of the network layer	Industry	Final text
	LTE-based vehicular communication--Test methods of network layer	Industry	Final text
Message layer	LTE-based vehicular communication--Technic requirements of message layer	Industry	Final text
	Cooperative intelligent transportation system—Vehicular communication application layer specification and data exchange standard	Group	Publish
	LTE-based vehicular communication—Test methods of message layer	Industry	Final text
Security layer	LTE-based vehicular communication—Security technic requirements	Industry	Final text
	LTE-based vehicular communication—Technic requirements and test methods of certificate authority	Industry	PWI
	Technical Requirement of Security Certificate Management System for LTE-based Vehicular Communication	Industry	Final text
General Guidelines of technical requirements	LTE-based vehicular communication—Technic requirements and test methods of on-board terminal equipment supporting direct communication	Industry	Final text
	LTE-based vehicular communication—Technic requirements and test methods of RSU supporting direct communication	Industry	Final text
	LTE-based vehicular communication— Technic requirements and test methods of equipment of base station	Industry	Final text
	LTE-based vehicular communication—Technic requirements and test methods of core network equipment	Industry	Final text
	LTE-based vehicular communication—Technic requirements of direct communication system	Group	Draft
	Technic requirements of LTE-based direct communication of on-board information interactive system	GB	PWI

C-V2X Infrastructure Takes Shape

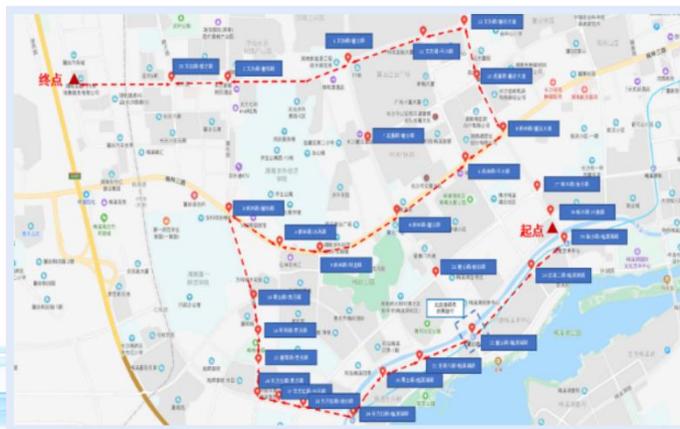
- More than 3,000 sets of roadside infrastructure have been constructed nationwide
- More than 1.425 million 5G base stations have been established.



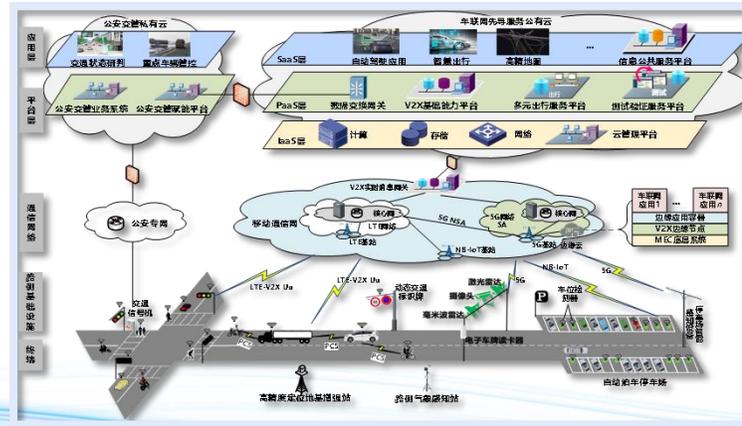
Beijing high-level cloud-controlled autonomous driving demonstration zone



Chongqing intelligent highway



Changsha intelligent routes



Wuxi city-level demonstrate application architecture

Series of C-V2X Demonstration Activities

□ CAICV and IMT2020 build a **cross-industry** collaborative testing and verification platform

2018 Three Cross-Industry

- Modules
- Terminals
- OEMs

2019 Four Cross-industry

- Modules
- Terminals
- OEMs
- Certificate Authority
- Open Road

2020 New Four Cross-industry

- HD Map & Positioning
- Cloud Control Platform
- Industrialization and enhanced scenario
- Closer to the actual travel scenario

2021 Pioneer Application Demonstration

- Multi-location scenario demonstration
- Integration of intelligence and connection
- Mass application

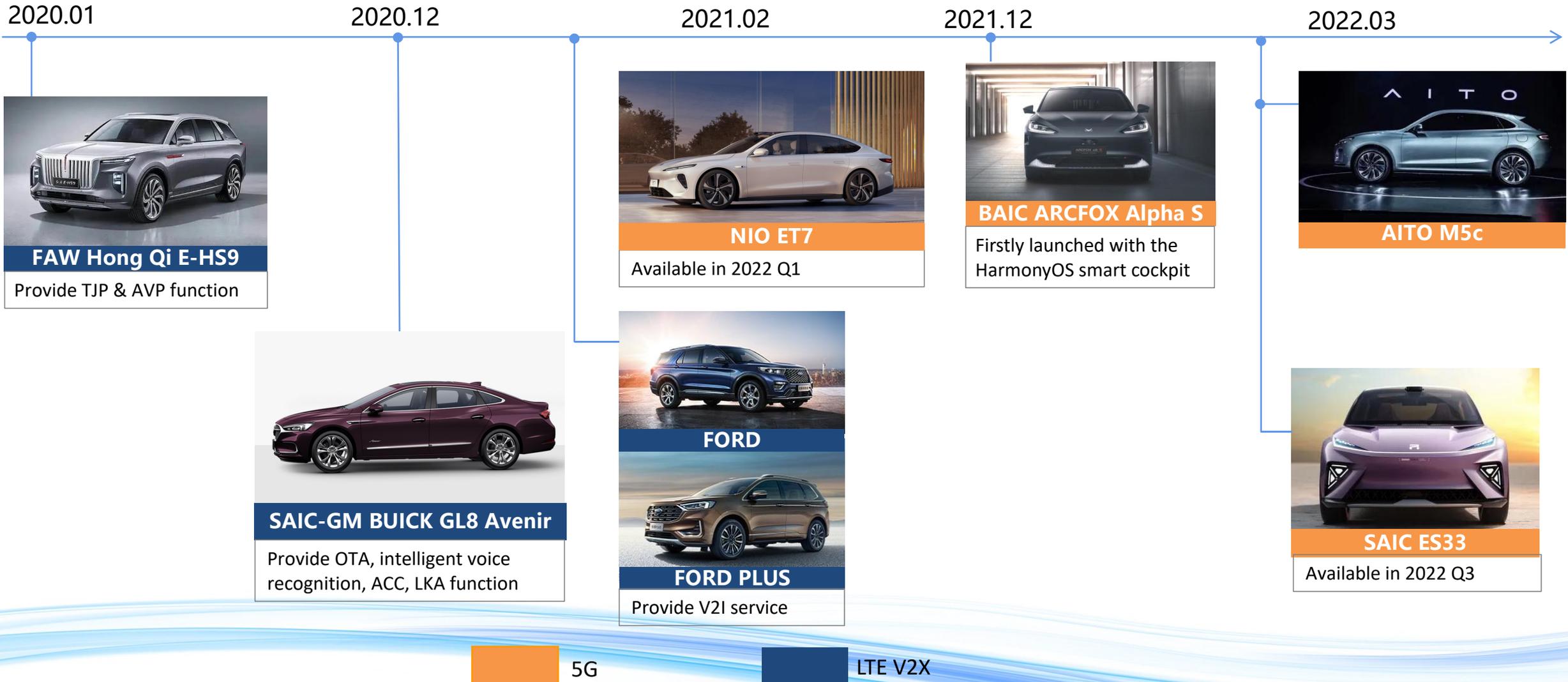
2022 Application Demonstration

- Vehicle mass production
- Best practice
- Innovation application

□ Fully verify LTE-V2X technology and related standards and further promote the industrialization of C-V2X in China.

Mass Products with C-V2X technology

□ Mainstream auto enterprises have released mass produced models equipped with C-V2X technology



Development of Integration of Automation and Connectivity

Test & Verification

- The standard system has matured
- The Lab Tests - Physical Tests – Real World Tests have been completed
- Large-scale testing and verification are being organized

Scale-based Construction

- To complete infrastructure construction with full coverage of city road and highway
- To increase the deployment rate of OBU
- To improve application scenarios
- More focus on information reminder and support ADAS functions

Vehicle-road Cooperative autonomous driving

- When road infrastructure construction and on-board communication system equipment reach a high percentage of coverage, network connection begins to support intelligence and cooperative autonomous driving will be realized.

Cooperative ADAS



Cooperative autonomous driving

Contents

1

Introduction of CSAE and CAICV

2

China C-V2X Industry

3

CSAE/CAICV Working Progress in 2021

4

CSAE/CAICV Working Plan in 2022

CAICV Releases ICV Group Standard System

- To implement the cooperation with NTCAS, CAICV released the Guideline for the Construction of ICV Group Standard System on Sept. 15, 2020 and amend in Dec. 13, 2021.



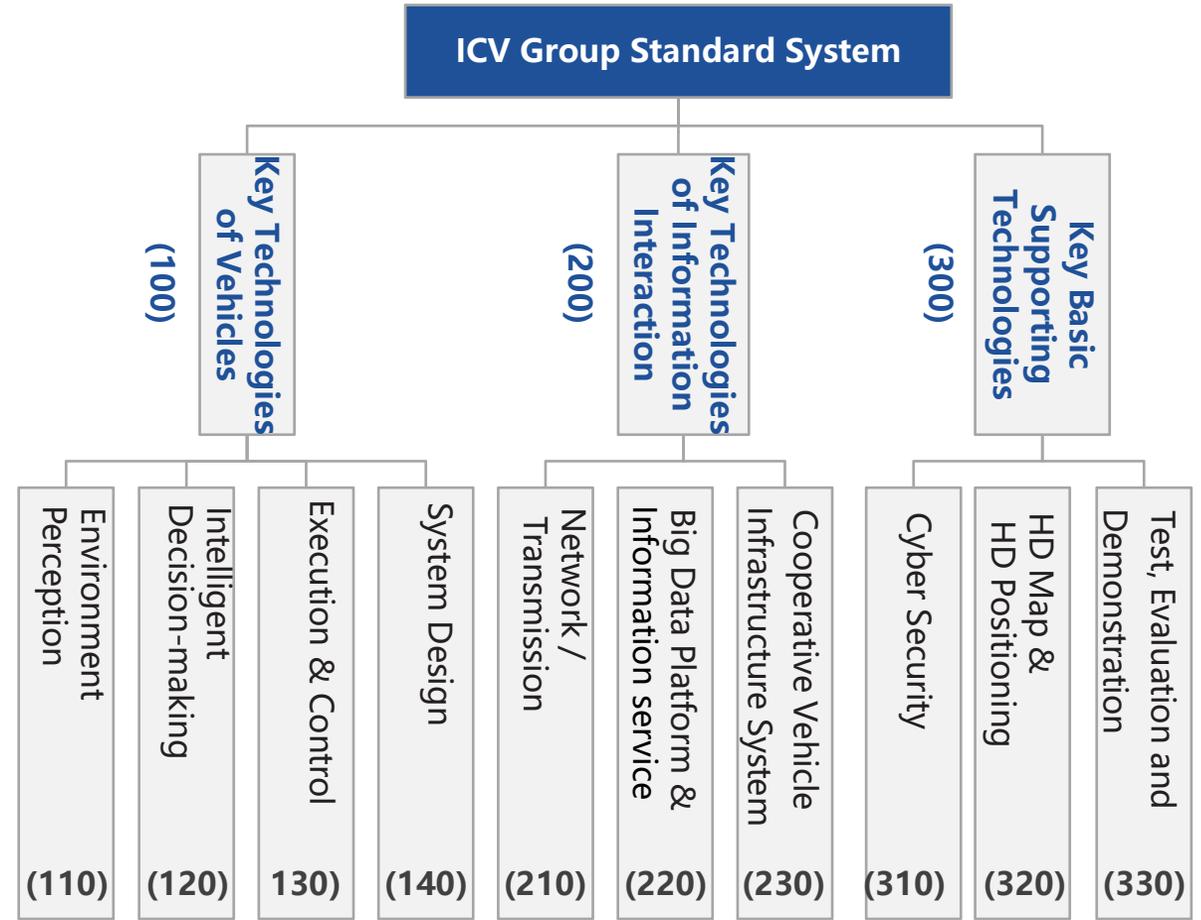
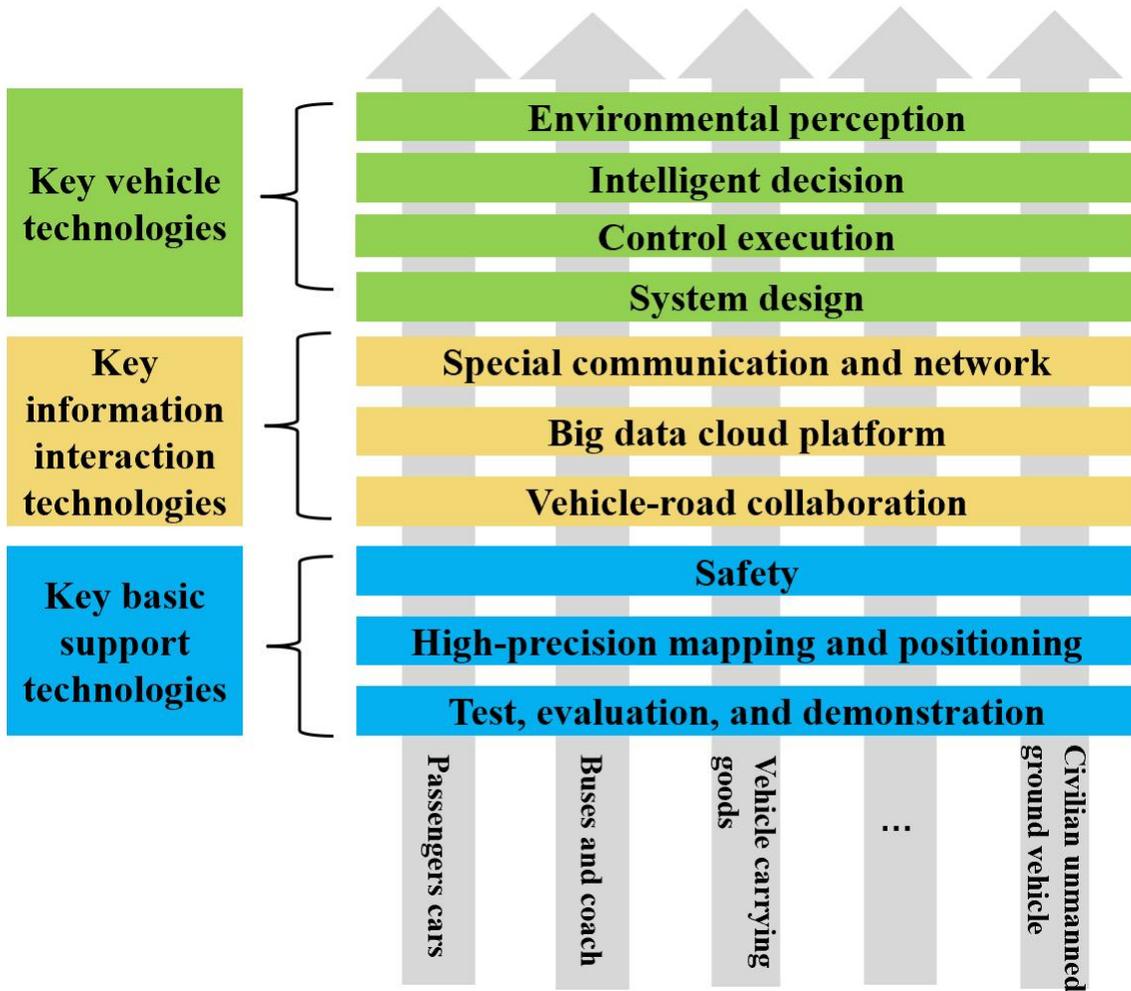
Supported by



Organization
Implementation



ICV Group Standard System



“3 (3 key technologies) +N (N innovation applications) ”
 ICV Group Standard System Research Framework

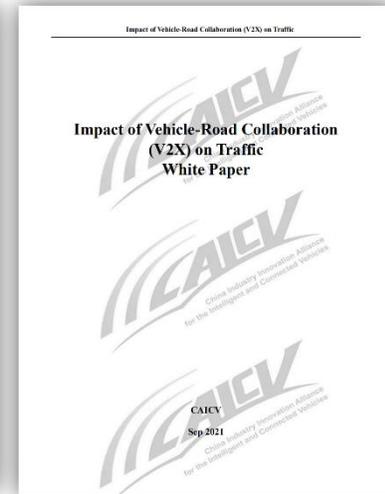
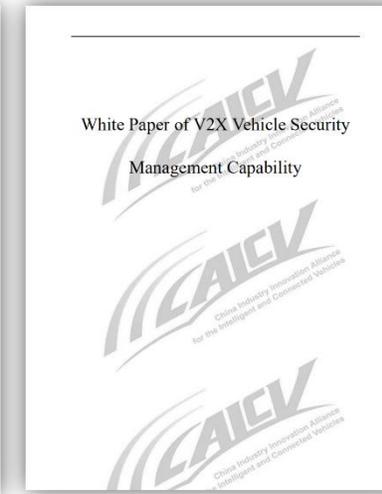
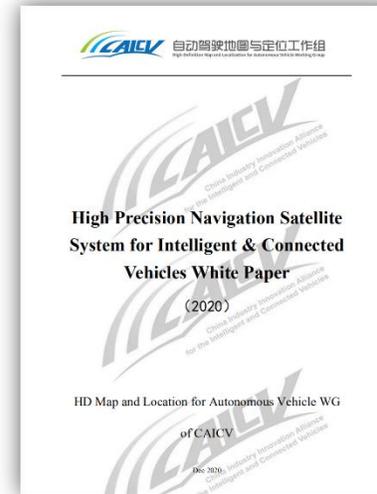
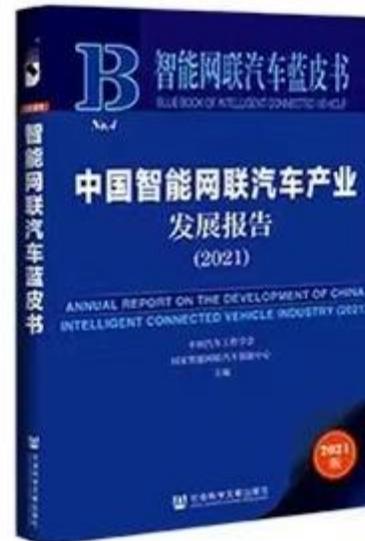
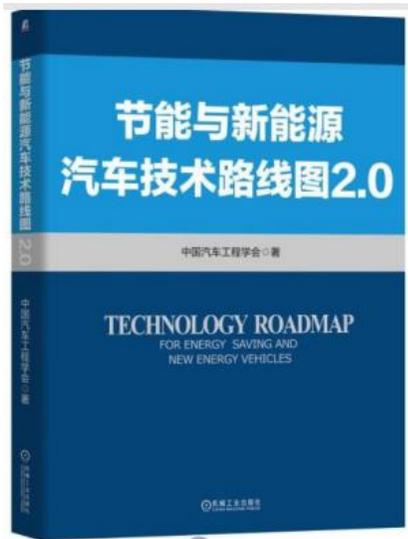
ICV Group Standard System Research Framework

ICV Group Standard System

Standard Classification	93 standards (stds) in 2020 212 standards in 2021
Key Technologies of Vehicles (100)	<ul style="list-style-type: none">✓ Environmental Perception (101): 16 stds✓ Intelligent Decision-making (102) : 2 stds✓ Control & execution (103) : 8 stds✓ System Design (104) : 39 stds (New EEA: 11 stds, HMI: 7 stds, Computing Platforms: 21 stds)
Key Technologies of Information Interaction (200)	<ul style="list-style-type: none">✓ Network / Transmission (201) : 15 stds✓ Big Data Platform & Information Service (202) : 10 stds✓ Cooperative Vehicle Infrastructure System (203) : 24 stds
Key Basic Supporting Technologies (300)	<ul style="list-style-type: none">✓ Security (301) : 26 stds (SOTIF 4 stds; Data safety 4 stds, Cyber security 19 stds, including Intelligent Vehicle Cyber security: 9 stds, Communication Network Cyber Security: 4 stds, Cloud Platform and Infrastructure Cyber Security: 6 stds)✓ HD Map & HD Positioning (302) : 22 stds✓ Test, Evaluation and Demonstration (303) : 49 stds

Published Reports

- ❑ Technology Roadmap for Intelligent & Connected Vehicles has built a technological development system and defined a technological development direction for China's intelligent connected vehicle (ICV) industry.
- ❑ Annual Report announces industry development status and popularizes ICV technology to the public.
- ❑ White Paper and Report resolves industry specific issues and gives inspiration to government and enterprise



Technology Roadmap for Intelligent & Connected Vehicles 2.0 is released in 2020

Annual Report on the Development of China Intelligent Connected Vehicle Industry (2021)

White Paper for specific focus

Contents

1

Introduction of CSAE and CAICV

2

China C-V2X Industry

3

CSAE/CAICV Working Progress in 2021

4

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Working Plan in 2022

Topics of Standard Research

- ❑ Position and time synchronization without GNSS (e.g., tunnel, bridge)
- ❑ Application data exchange
- ❑ Scenarios database and scenarios simulation
- ❑ Series of cloud control system requirements (data exchange, scenarios, QoS, and testing methods)
- ❑ RSU profile (Amendment)
- ❑ Field test methods and requirements
- ❑ Civilian unmanned ground vehicle
- ❑ Automated valet parking

Topics of Industry Research

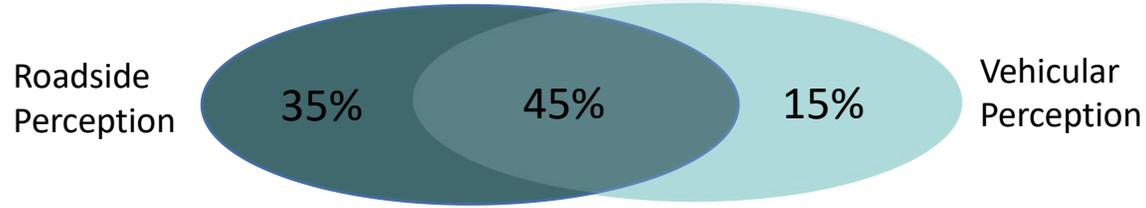
- ❑ **Roadmap for the Integration of Automation and Connectivity**
- ❑ Test and evaluation of software update (OTA)
- ❑ Smart travel and Robotaxi commercialization path

Test & Demonstration Activity

- ❑ C-V2X Application Demonstration of ICV in 2022 - the 1st CICV "Zhixing Cup" Vehicle-Road Collaboration Practice Award

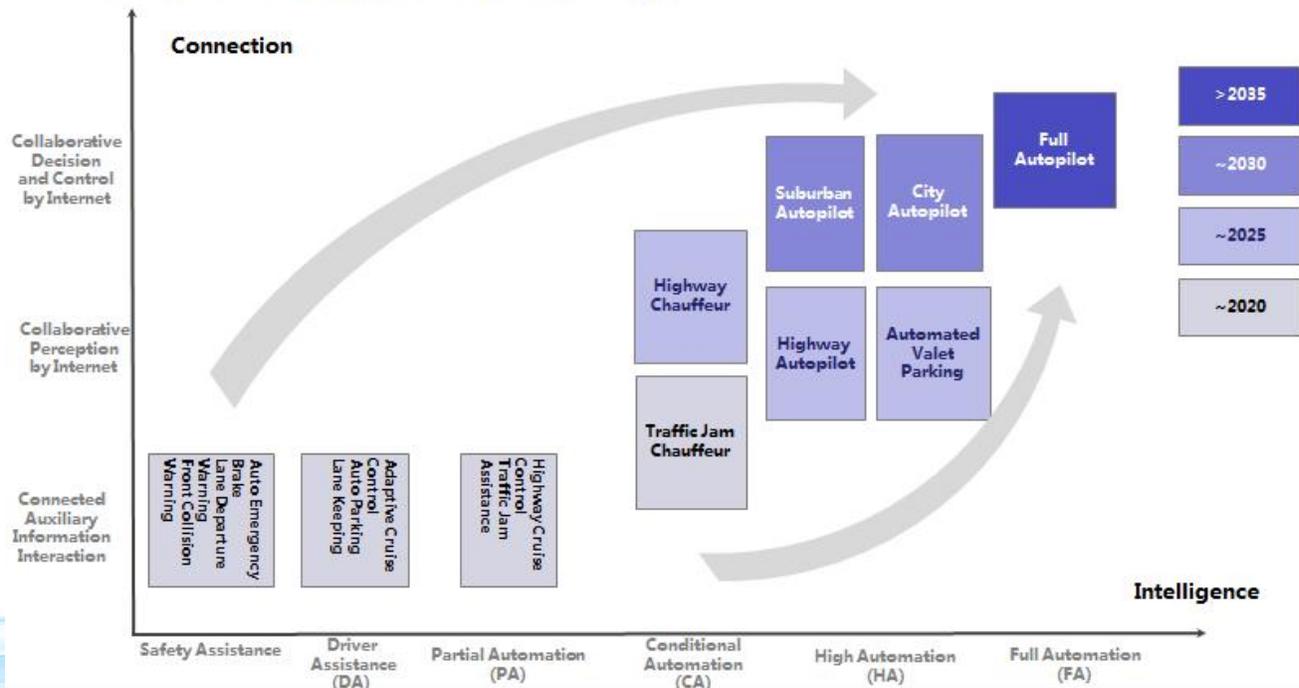
Roadmap for the Integration of Automation and Connectivity

96% of accidents are avoidable, 36% scenarios rely on V2X



Resource: U.S. Department of Transportation

Milestones of Intelligent Connected Passenger Vehicles — NEW



1. Global vehicle-road-cloud integration development status

- United States
- Europe
- Other countries and regions
- China
- International best practices

2. The development problem of vehicle-road-cloud integration

- perception fusion technology
- roadside infrastructure
- penetration of vehicle terminals
- standard system
- ICV testing and evaluation system

3. The vehicle-road-cloud integration goals for different development phases

- Key scenarios
- Key technologies
- Test and evaluation

4. The future development path of vehicle-road-cloud integration

Thanks for Your Attention



CSAE

<http://www.sae-china.org/>



CICV

<http://www.china-icv.cn/>



CAICV

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