Guideline of Intelligent and Connected Vehicle Standard System
(The new version released in 2023)

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Part 1

Background of ICV Standard System
For the first time, China released a guideline of ICV standard development for automotive industry.
Set up work objectives for 2020 and 2025.
By the year of 2022, the system is capable of supporting driver assistance and low-level automated driving.

The work plan future extends to the stages of 2025 and 2030
Respond to the new demand of technology integration and cross-field development
The logical hierarchy is clearer and the technical fields are more comprehensive
The objective of the new system is to be capable of supporting high-level automated driving
The development of standards includes basics, safety assurance, driving assistance, automated driving, and information services on vehicle. 56 standards have been completed (a few of them are in pre-publication phase). 39 standards are under development. Capable of supporting driver assistance and low-level automated driving.

1. The Establishment of ICV Sub-committee under NTCAS

- The working scope is the standardization of ICV technical fields such as vehicle driving environment perception and warning, driving assistance, automated driving and information services on vehicle.
- Develop standards through 10 working groups.

2. The Establishment of First Stage’s ICV Standard System

- The development of standards includes basics, safety assurance, driving assistance, automated driving, connectivity functions and their applications, resource management and information services.
- 56 standards have been completed (a few of them are in pre-publication phase).
- 39 standards are under development.
- Capable of supporting driver assistance and low-level automated driving.

3. Actively participate in the harmonization of international regulations and standards for ICV

- WP.29, ISO, IEC...
1.3 New Demands from ICV Industry

Technology Innovation
- Perception and control algorithms
- Combined driving assistance
- Automated driving
- Connectivity technology
- Cybersecurity and data security

Industry Development
- ADAS and AD are maturing
- Connection technology are expanding
- Software and chips are more valuable
- Data and platform are growing
- New security technologies are more important

Government Supervision
- Industry goes into the stage of mass production and application
- The functional scope of ADAS and the responsibility boundary of AD need to be clarified
- A comprehensive security system needs to be established
- Safety requirements and development costs need balance
- Policies and international regulations need coordination

Based on the above demands, we follow these principles to establish the new system:

- Overall Planning
- Ensure Safety
- Compatible, Dynamic
- Serve Demands
Contents of the ICV Standard System (2023 Version)
Take full account of ICV technology classification and cross-field collaboration, and form a "three horizontal and two vertical" technical logic architecture.

**Technology Classification**

- **Horizontal**: The technology logic components supporting ICV function are classified to form a three-layer architecture: top layer perception and communication, middle layer decision and control, and bottom layer resource management application support.

- **Vertical**: The ICV security technology is sorted out to form a two-tier architecture: the tier of functional safety and SOTIF, the tier of cybersecurity and data security.

**Cross-domain Technology Interaction**

- Considering the technical correlation between ICV and transportation, communication, electronics and other fields, reflecting the characteristics of cross-industry collaboration, and jointly building an organic whole of collaborative development with ICV as the core.
The framework is formed by considering different functions, products and technologies and the relationship among them comprehensively.

ICV Standard System 2023 Version

(100) Basics

(110) Terms and Definitions
(120) Classification
(130) Symbols and Codes
(210) Functional Safety and SOTIF
(220) Cybersecurity and Data Security
(230) HMI
(240) Maps and Positioning
(250) EMC
(260) Evaluation System and Tools
(310) Information Perception and Integration
(320) Advanced Driving Assistance
(330) Automated Driving
(340) Connection Function and Application
(350) Resource Management and Application
(211) Functional Safety
(212) SOTIF
(221) Cybersecurity
(222) Data Security
(231) Driving Interaction
(232) Cockpit Interaction
(234) Test Equipment and Tools
(241) Test Scenarios
(311) Radar and Camera
(312) Vehicle Information Interaction Terminal
(313) Perception Fusion
(321) Information Assistance
(322) Control Assistance
(314) Functional Specification
(331) Test Methods
(333) Critical System
(341) Functional Specification
(342) Application of Connection Technology
(351) Platform Architecture
(352) Vehicle Software
(353) Vehicle Chips

Major Changes

- Moderate increase in quantity: Planning 140+ standards
- More clear in logic:
  - The first level is categorized by standard type
  - The second level is categorized by technical field
  - The third level is categorized by standard content
- More comprehensive in fields:
  - Add the field of data security
  - Add the field of evaluation systems and tool
  - Add the field of resource management and application
- More complete in contents:
  - Cover common key technologies such as platform architecture, vehicle software and chips
Unify basic ICV concepts, clarify objects and boundaries, and form a standardized "common language"

**Terms and Definitions**
- Unify basic ICV concepts
- Provide standardized terminology support for other standards

**Classification**
- Support stakeholders in understanding objects of ICV standard
- Sort out the hierarchy and connections of each object

**Symbols and Codes**
- Unified identifiers for ICV standardized objects
- Form the basic rules and standards in the ICV field

**Contents**
- Current standards: terms and definitions of ICV, terms and definitions of ADAS
- Planning standards: terms and definitions of AD test scenarios
- Current standards: taxonomy of driving automation, operational design conditions
- Planning standards: taxonomy of connection for vehicles, taxonomy of cybersecurity protection, etc
- Current standards: marking of controls, indicators and signaling devices
- Planning standards: automotive software identification code, automotive data format and coding, etc
### General Specifications and Standards of ICV Technology and Product Safety

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functional Safety</strong></td>
<td>Ensures safe operation of the vehicle in case of electrical and electronic system failure. Functional safety requirements and testing, functional safety testing of automated driving V2X interactive, functional safety audit and evaluation, etc.</td>
</tr>
<tr>
<td><strong>Cybersecurity</strong></td>
<td>Safety assurance and safety technology standards. Vehicle information security, software upgrade, gateway, interactive system, remote terminal, diagnostic interface information security, etc.</td>
</tr>
<tr>
<td><strong>Safety Of The Intended Functionality (SOTIF)</strong></td>
<td>Avoid risks caused by inadequate design, performance limitations, and human misuse. SOTIF verification methods of SOTIF, etc.</td>
</tr>
<tr>
<td><strong>Data security</strong></td>
<td>Ensure that ICV data is effectively protected and legally exploited, and have the ability to ensure continued security. Data general requirements, data security management system, data application and sharing, etc.</td>
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### New Common Specification Standards to Support the Implementation of ICV Functions

<table>
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<tr>
<th>Feature</th>
<th>Details</th>
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<tbody>
<tr>
<td><strong>Human Machine Interface (HMI)</strong></td>
<td>Driving interaction and cockpit interaction. Signal prompt general requirements, user notification, face recognition, etc.</td>
</tr>
<tr>
<td><strong>Maps and Positioning</strong></td>
<td>Coordinate system, vehicle map, positioning, navigation. Integrated positioning, vehicle maps, inertial navigation, etc.</td>
</tr>
<tr>
<td><strong>Electromagnetic Compatibility (EMC)</strong></td>
<td>Test scenarios, adaptability requirements, test methods. ICV electromagnetic compatibility test scenarios, ICV electromagnetic compatibility test methods, etc.</td>
</tr>
<tr>
<td><strong>Evaluation systems and tools</strong></td>
<td>Evaluation and audit capabilities, management and development processes, equipment and tools, test scenarios. Perception evaluation target, automated driving test scenario, subjective evaluation, etc.</td>
</tr>
</tbody>
</table>

★ Build a New Four-dimensional Safety System for ICV

★ New General Specifications and Standards such as Cockpit Interaction, Map Positioning, EMC, and Evaluation System have been added
Form the standards of application of products and technologies based on intelligence and connection function, supported by perception and integration, resource management and application.

### Intelligence Connection

#### ADAS
- AEB
- LKA
- BSD
- DOW
- DAM
- RCTA

Information assistance + control assistance

#### AD
- General requirements
- Key scenarios
- Track test
- Real world test
- Virtual test
- DSSAD

General requirements + test methods + critical systems

### Connection function and application

#### Information perception and integration
- Radar
- Camera
- T-BOX
- EDR

Perception component + information interaction terminal + Perception and Integration

#### Resource management and application
- Vehicle OS
- Vehicle software
- EE architecture
- Automotive chips
- Interface
- Cloud control platform

Platform architecture + chip + software

### Foundation support

- Information Assistance
- Digital key
- LTE-V2X
- 5G-NR

Connection technology + functional specifications
3
Part 3

Future Plan
- 1- Provide comprehensive standards as basis for ICV industrial management

- 2- Guide the development path of ICV technology

- 3- Improve the ICV test and evaluation capabilities

- 4- Change the form of standards or regulations. e.g. the implementation may rely on data bases

- 5- Revise the traditional vehicle standards and improve their fitness for ADS

3.1 Potential Influence of New Standard System
With a view to 2025 and 2030, a standard system for ICVs that adapts to China's national conditions and harmonized with international standards will be established in stages.

2025
To form a standard system for ICVs that can support the general functions of combined driving assistance and automated driving.

2030
A comprehensive ICV standard system that can support the harmonized development of single vehicle intelligence and multiple vehicles connection will be formed systematically.

More than 100 related standards will be developed or revised.
More than 140 related standards will be developed or revised.
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