13th Japan ITS Promotion Forum

Human Factors

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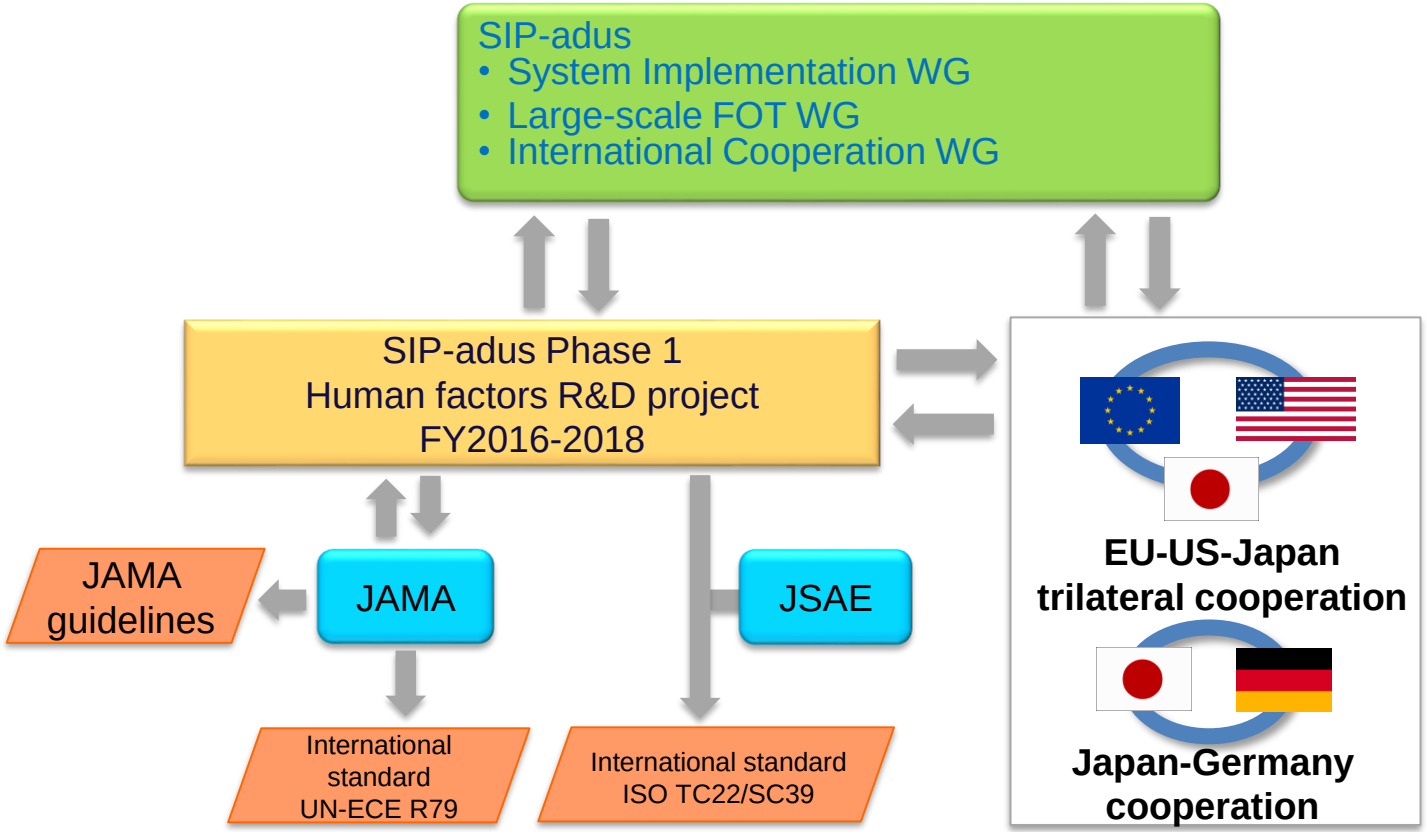
SIP Cabinet Office

Positioning of Human Factors R&D



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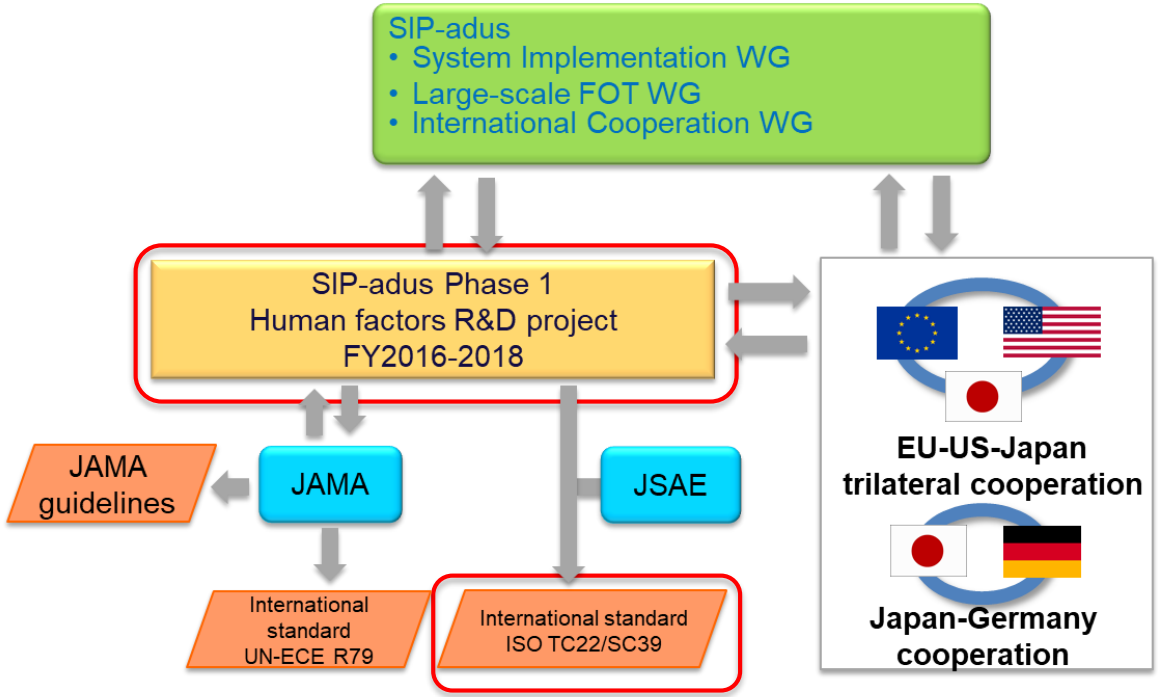


1

R&D

Tasks To Be Addressed

The industry-academia-government task force identified issues related to human factors of automated driving systems (FY2015). Three priority issues were identified in the cooperative area.

Task A

Clarify the impacts of information about the functions and state of Level 2 and Level 3 automated driving systems (knowledge information & dynamic data) on the driver's takeover behavior, as well as effective information communication method

Task B

Understand the impacts of the driver state (readiness) during Level 2 and Level 3 automated driving on the driver's takeover behavior, and establish metrics of readiness for driver monitoring

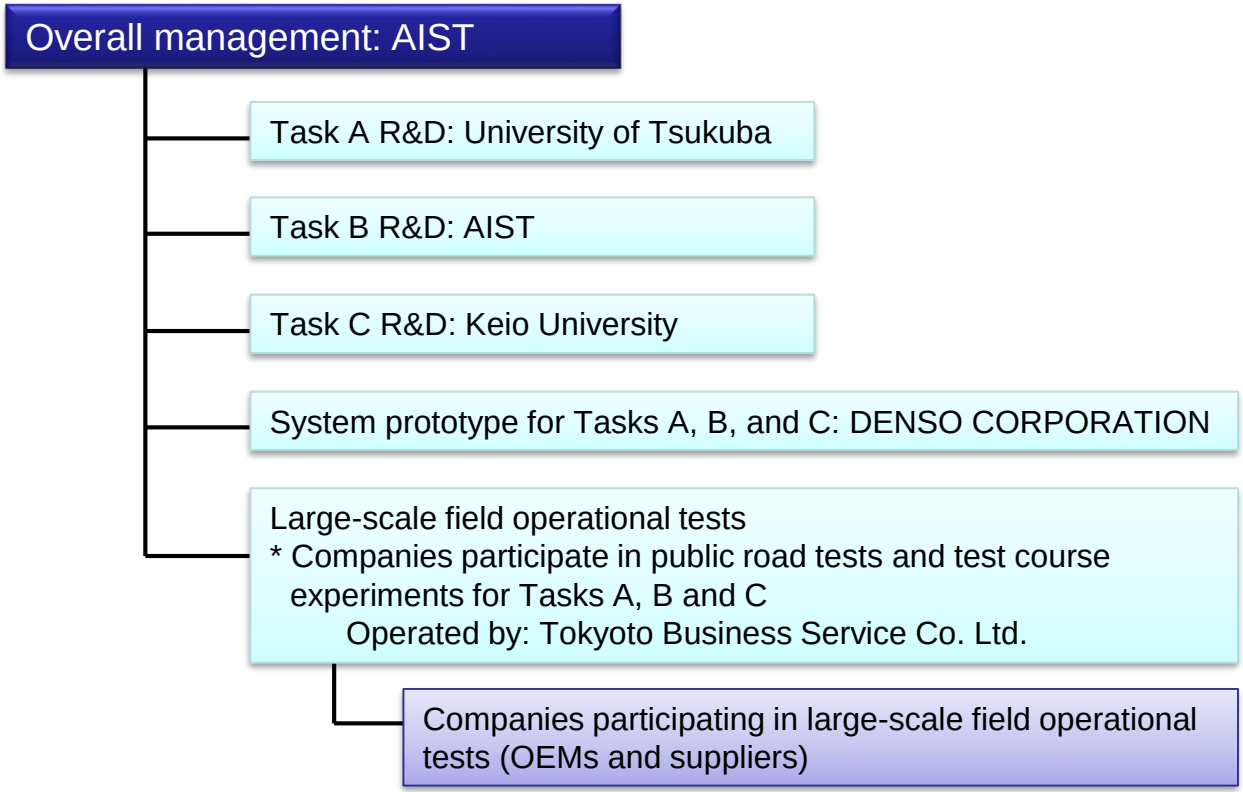
Task C

Establish design guidelines for the means of on-road communication with other road users that should be provided by automated driving vehicles of Level 2 or higher

SIP

R&D Organization and Roles

Industry-academia cooperation consortium for SIP-adus human factors R&D



Overview of Task A

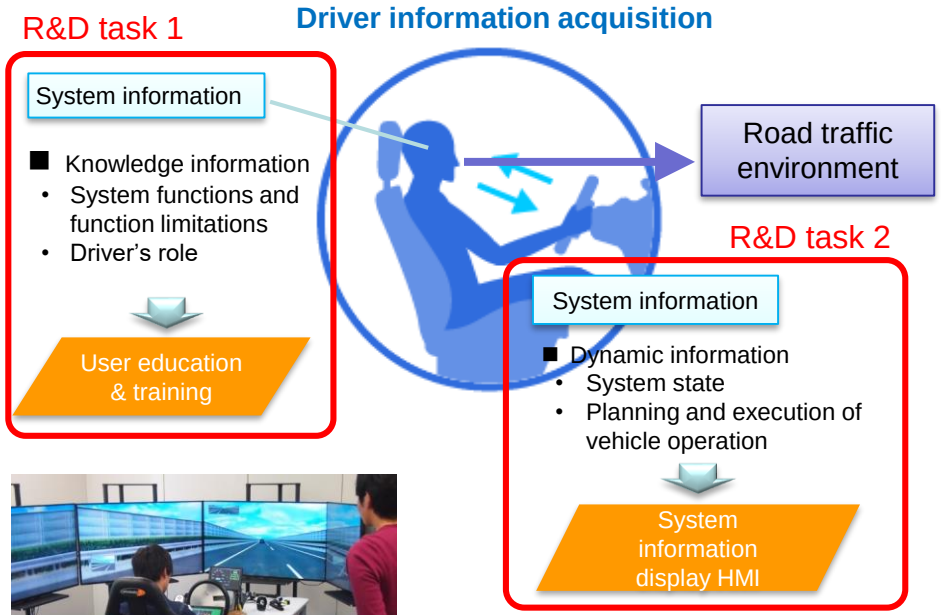
Task A: Clarify the impacts of information about the functions and state of Level 2 and Level 3 automated driving systems (knowledge information & dynamic data) on the driver's takeover behavior, as well as effective information communication method

R&D task 1

- The necessary conditions for improving the driver's performance in terms of the content and method of conveying knowledge information were clarified. Explanation of the HMI display and examples of takeover situations was particularly effective.
- The takeover performance improves by experiencing similar takeover situations (driving simulator).

R&D task 2

- Some information about the dynamic system state during driving was found to be effective for successful takeover:
  - Display of detected targets & driving plan
  - Display of environment recognition reliability
  - Display of mode shift
  - Display of route and current position, etc.



Experiment at University of Tsukuba

Overview of Task B

Task B: Understand the impacts of the driver state (readiness) during Level 2 and Level 3 automated driving on the driver's takeover behavior, and establish metrics of readiness for driver monitoring

R&D task 1

It was found that decline in alertness, mental distraction, and taking eyes off of the road by the driver during automated driving have different adverse effects when takeover is necessary.

- Decline in alertness → delayed response from RtI to holding the steering wheel
- Mental distraction → delayed action after holding the steering wheel
- Taking eyes off of the road → Abrupt operation beyond the scope required after holding the steering wheel

R&D task 2

The driver's decline in alertness, mental distraction, and taking eyes off of the road can be monitored based on indices determined based on the camera image such as eye movement, blinking, percentage of frontal visual recognition, and percentage eye closure.

Physiological and behavior measurement of drivers on the AIST test course

- Warning
- Stimulus presentation
- Suspension of automated driving, etc.

Overview of Task C

Task C: Establish design guidelines for the means of on-road communication with other road users that should be provided by automated driving vehicles of Level 2 or higher

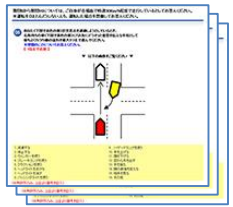
R&D task 1：Understand the current on-road communication

- Most on-road communication aims to convey the intention to yield to other road users. Such intention is conveyed and understood mainly by deceleration.
- On-road communication brings the benefits of safety, a sense of security, smooth traffic, and social acceptance.

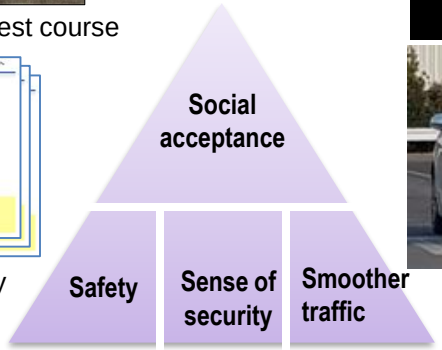
Fixed-point observation

Experiment on a test course

In-vehicle observation/ measurement

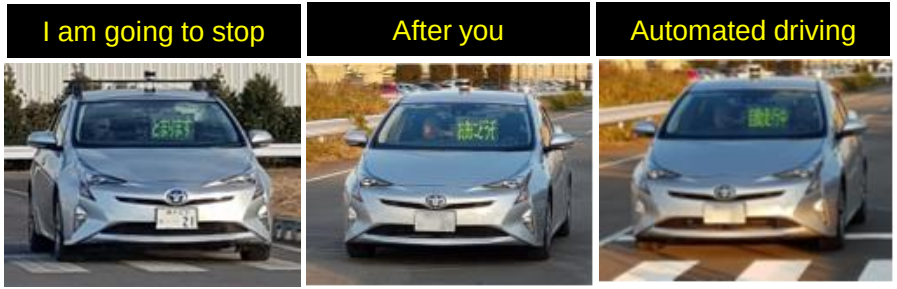


Web survey



R&D task 2：Recommendations for automated driving vehicles

- An external HMI is effective to help convey the intention when the deceleration behavior is small. However, the information of “in automated driving mode” may confuse other road users.
- Understanding of on-road communication is affected by the attributes of road users (e.g., with/without a driving license) and social norms. The results suggested the need for universal design, standardization, and education.
- An external HMI may trigger unsafe behavior by other road users. Further verification will be conducted.



Experiment to simulate an external HMI on a test course

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International Standardization

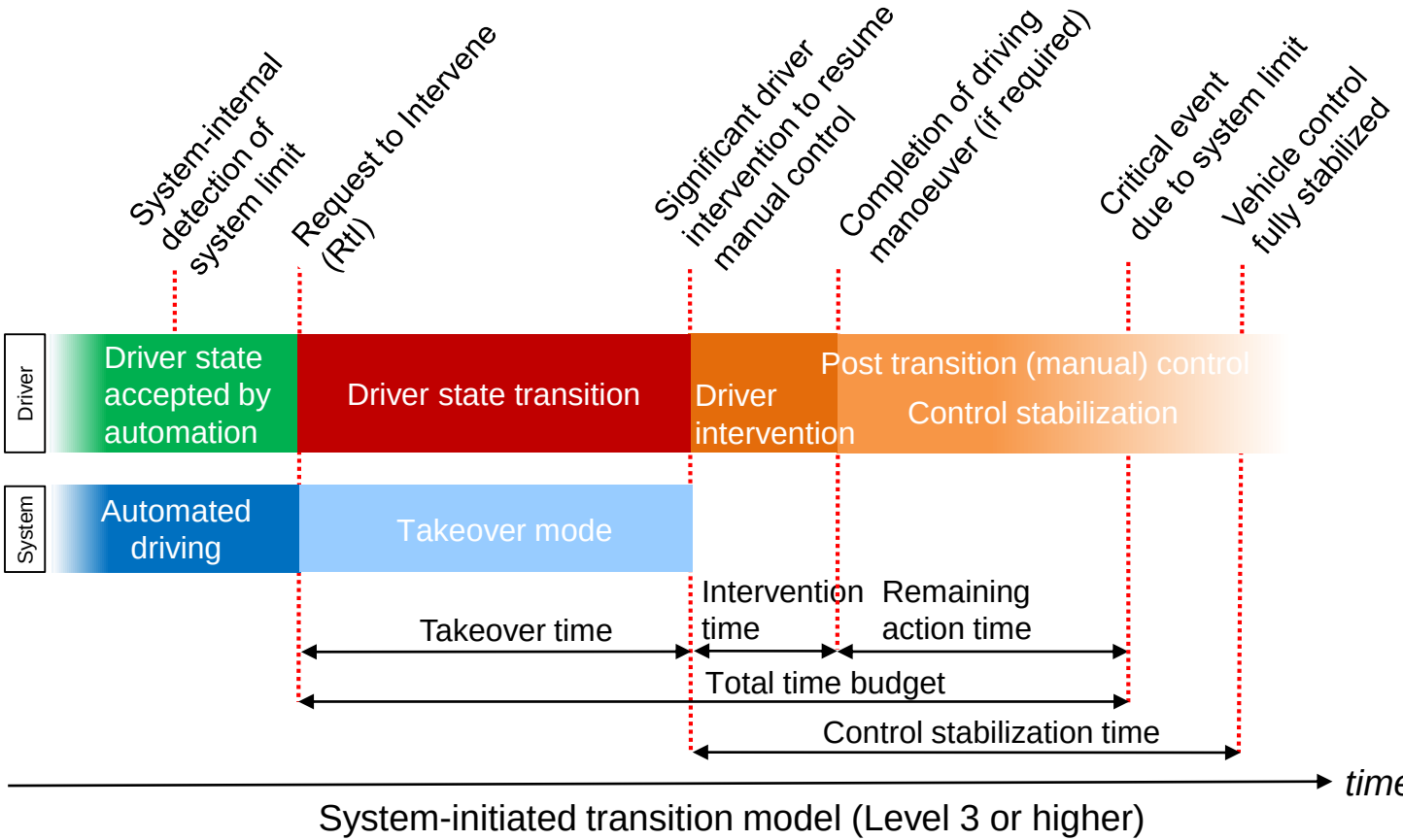
Developments in Ergonomics-related Standardization for Automated Driving ISO/TC22/SC39/WG8

■ Reflection of results of Tasks A and B	Status
• **TR 21959 – Part 1** Road vehicles — Human performance and state in the context of automated driving — Part 1: Common underlying concepts	Published in 2018
• **TR 21959 – Part 2** Road vehicles — Human performance and state in the context of automated driving — Consideration in designing experiments to investigate transition processes	Project commenced in April 2018 To be published by the end of 2019

■ Reflection of results of Task C	
• **TR 23049** Road vehicles — Ergonomic aspects of external visual communication from automated vehicles to other road users	Published in 2018
• **TR 23720** Road vehicles — Methods for evaluating other road user behavior in the presence of automated vehicle external communication	Approved as a new project in 2018
• **TR 23735** Road vehicles — Ergonomic design guidance for external visual communication from automated vehicles to other road users	Approved as a new project in 2018

Outline of TR 21959 – Part 1

Definition of terms based on the transition process models



System-initiated transition model (Level 3 or higher)

Outline of TR 21959 – Part 2

Matters that should be taken into account in experiments to evaluate driver performance in takeover
(factors that affect the performance evaluation results)

* They do not restrict or set the direction of the system design guidelines or designs.

5. Transition process models
6. Human factors that influence takeover performance
7. System factors that influence takeover performance
8. Test scenarios
9. Takeover performance
10. Testing environments

Annex A Human Machine Interfaces/interactions for automated vehicles

Thank you

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