

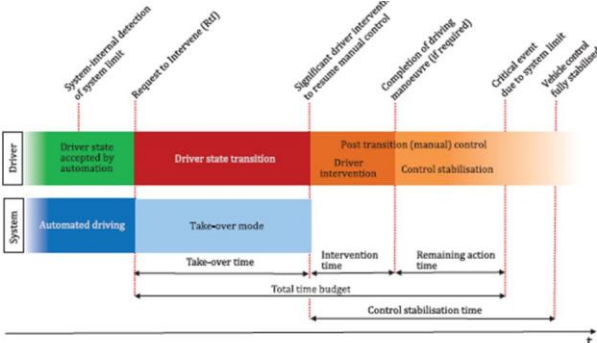
HF-working stream: Proposed detailed HF-related requirements

The performance topics and detailed requirements described below aim to increase the usability of the technology, simplicity in the perception of the user and an appropriate mental model of the ADS to ensure a safe usage of the ADS. The need for an appropriate mental model has been stated by Halasz and Moran (1983): “Our theoretical view is that the psychological function of a mental model of a system is to provide an effective problem space [...] in which the user can reason about the operations available on the system.” All the requirements below have been derived from these safety-related considerations.

Halasz, F. G., & Moran, T. P. (1983). Mental models and problem solving in using a calculator. In Proceedings of CH1’83 Human Factors in Computing Systems. New York: ACM

	Performance Topic	Detailed Requirements	Comments
The ADS should interact safely with the user			
9 old	Activation of an ADS feature should only be possible when the conditions of its ODD have been met		Included in new PT12
9 new	User interaction with and the interface of ADS (features) should have high-level commonality of design so as to support users’ mental model of system operation ADS (features) should be designed according to Harmonized/Common HMI principles to support the mental model	1) The ADS (features) should use interfaces with high-level of commonality 2) The operation design of the interaction should have be in common: a) [use of common sequence of states in the transition/activation/overriding/...] 3) The interaction should be simplified: a) [Limit the number of roles] b) [Limit the number of potential transitions] c) [Limit the number of settings] d) [Limit the number of different interaction modes]	Japan: Explain mental model Reply: will be done in the introduction
10 old	The user should be informed about the ADS status (when the ADS is activated) with regards to ODD		Included in PT10
10 new	The ADS should provide clear and unambiguous information to the user	1) The ADS should inform present information to the user on the current conditions:	Open issue:

		<ul style="list-style-type: none"> a) ADS status information b) User Role c) Potential roles to activate d) Responsibility e) Permitted NDRA f) “Standard” information <ul style="list-style-type: none"> i) Vehicle speed, range and Time to Fuel g) ADS failure information h) Availability of automated features <p>2) The ADS should inform present information to the user on the upcoming conditions:</p> <ul style="list-style-type: none"> a) ODD boundaries b) Upcoming actions or change in roles c) Oncoming decisions/manoeuvres d) Estimated time to overtake in normal conditions e) Warning for upcoming transition request f) Confirmation request for upcoming transition <p>3) The ADS should present the information so as to assure a safe interaction:</p> <ul style="list-style-type: none"> a) Timing requirements b) Priority requirements c) Saliency requirements 	<p>Which information needs to be presented continuously?</p>
<p>11 old</p>	<p>The user should be permitted to take over control from the ADS, if the ADS is designed to request and enable intervention by a human driver</p>		<p>Included in new PT14</p>
<p>11 new</p>	<p>The ADS should prevent misuse and errors in operation</p>	<ul style="list-style-type: none"> 1) The ADS should be designed to prevent inadvertent activation or deactivation 2) The controls dedicated to the ADS should be clearly distinguishable from other controls 3) The ADS should be designed to avoid activation of an ADS outside its ODD 4) The ADS should be designed to avoid illegal settings 	

		5) The ADS should provide feedback when the user attempts to enable not allowed functions	
12 old	The ADS should safely manage transitions of control to the user		Included in new PT13 and PT14
12 new	The ADS should assure a safe ADS feature activation	<ol style="list-style-type: none"> 1) The ADS should inform the user that preconditions for activation are met 2) The activation should follow a common sequence <ol style="list-style-type: none"> a) Common sequence to be a pass/fail criterion 3) The ADS should provide confirmation that the system is activated 	<p>Clarification to remarks by OICA / CLEPA and Canada on merging and differences between the PTs:</p> <p>Reply: There are relevant differences from a user perspective and the requirements of the ADS between 12, 13, 14.</p>
13 old	The ADS should safely respond to user input errors		Included in new PT11
13 new	The ADS should assure a safe Transition Of Control	<ol style="list-style-type: none"> 1) The interaction should follow a common sequence in the transition of control (change of user roles) <ol style="list-style-type: none"> a) Common sequence to be a pass/fail criterion  <p>Figure 2 — System-initiated transition from automated to manual driving ¹</p> <ol style="list-style-type: none"> 2) Transition of control should return to a common default user role (to prevent mode confusion and other risks) 	<p>Canada: Should automatic re-engagements of ADS be permitted?</p> <p>Reply: Automatic re-engagement strategies must be considered. Under certain conditions automatic re-engagement might be preferable. Currently not addressed</p>

¹ Reference: ISO/TR 21959-1:2020(E)

		<ul style="list-style-type: none"> a) This should normally be fully engaged driving (conventional driver) b) Common default user to be a pass/fail criterion 3) The ADS should continuously verify whether the user is available for the transition of control and warn the user if not available when required (MRM to be specified elsewhere) 4) The ADS should verify that the driver is in stable control of the vehicle to complete the Transfer of Control to the user 5) During transition, the ADS should remain active until the transfer of control has been completed or the ADS reaches a minimal risk condition 	
14 old	The ADS should provide feedback to the user on its operational status		Included in new PT10
14 new	The ADS should assure a safe user initiated take over	<ul style="list-style-type: none"> 1) Under safe conditions the user is allowed to initiate a take-over of the ADS 2) The deactivation should follow a common sequence <ul style="list-style-type: none"> a) Common sequence to be a pass/fail criterion 3) The ADS should prevent and warn a user for a user initiated take over that would likely will lead to an unsafe situation 4) The ADS should provide a clear feedback of the successful user initiated take over <ul style="list-style-type: none"> a) The clear feedback should be a pass/fail criterion 5) The user initiated take over should return to a common default user role (to prevent mode confusion and other risks) <ul style="list-style-type: none"> a) This should normally be fully engaged driving (conventional driver) b) Common default user role to be a pass/fail criterion 	USA: 3 should only apply in special circumstances. Reply: True. A strategy needs to be considered based on different cases. If a first attempt prevention is enough or the ADS has a better overview of complex traffic situations and prevents the take-over. Or other solutions.
15 old	The ADS should warn the user of failures to fulfill user roles and responsibilities		Included in new PT10
15 new	The ADS manufacturer OEM should provide tools for the authorized user to learn about system functionality and operation.	<p><i>On the general mental model (common understanding):</i></p> <ul style="list-style-type: none"> 1) ADS manufacturer OEM should describe the possible educational approach: <ul style="list-style-type: none"> a) Theoretical and practical training b) How it aligns with common HMI and interaction 	USA: Only apply to an authorized user (not e.g. a child). Reply: Done

		<ol style="list-style-type: none"> 2) ADS manufacturer OEM should provide documented information on ADS (features) capabilities and limitations (the information should also refer to specific scenarios) 3) ADS manufacturer OEM should provide documented information on roles and responsibility of Driver/user and ADS when ADS (feature) is on/off 4) ADS manufacturer OEM should provide documented information on allowed transition of roles and procedure for the transition (activation/deactivation, ToC, Override) 5) ADS manufacturer OEM should provide a list of NDRA allowed when an ADS feature is active <p><i>On the applied mental model (understanding the ADS-specifics)</i></p> <ol style="list-style-type: none"> 6) The ADS supports the user in correct operation (coaching) 7) The ADS gives prompt feedback on erroneous operation 	<p>Question: How do should allowed NDRA should be indicated.</p> <p>Reply: No idea yet but will be relevant at a more detailed level</p>
16	<p>ADS vehicles that may operate without a [user-in-charge/in-vehicle driver] should provide means for occupant communication with [a remote operator/user-in-charge/human driver/remote assistance personnel]</p>		<p>Has not yet been addressed.</p>

	Old Performance Topic	Included in new Performance Topic	New Performance Topic
The ADS should interact safely with the user			
9	Activation of an ADS feature should only be possible when the conditions of its ODD have been met	12	12: The ADS should assure a safe ADS feature activation
10	The user should be informed about the ADS status (when the ADS is activated) with regards to ODD	10	10: The ADS should provide clear and unambiguous information to the user
11	The user should be permitted to take over control from the ADS, if the ADS is designed to request and enable intervention by a human driver	14	14: The ADS should assure a safe user initiated take over
12	The ADS should safely manage transitions of control to the user	13, 14	13: The ADS should assure a safe Transition Of Control 14: The ADS should assure a safe user initiated take over
13	The ADS should safely respond to user input errors	11	11: The ADS should prevent misuse and errors in operation
14	The ADS should provide feedback to the user on its operational status	10	10: The ADS should provide clear and unambiguous information to the user
15	The ADS should warn the user of failures to fulfill user roles and responsibilities	10	10: The ADS should provide clear and unambiguous information to the user
16 (Not covered here)	ADS vehicles that may operate without a [user-in-charge/in-vehicle driver] should provide means for occupant communication with [a remote operator/user-in-charge/human driver/remote assistance personnel]		