

Automated navigation

Proposed definition of levels of automation in inland navigation (Revision 1)

Preliminary Definitions



















“Dynamic navigation tasks” are understood as the set of tactical vessel operations, such as operation of rudder apparatus, propulsion, anchor winches or elevating wheelhouse. The complexity of these tasks is dependent upon the context considered (for example, the manipulation of anchor winches can be excluded from a context, where the use of anchors is forbidden anyway).

“Context-specific” is understood as confined navigational conditions such as navigation on specific river waterway sections or lock crossing, as well as vessel arrangements with convoys or platooning. The context includes infrastructure relevant for automation, for example type and capacity of radio transmission networks.

“Navigational environment” is understood as fixed and dynamic conditions such as the waterways’ shape, water level, weather, visibility, vessel crossing, ... The navigation automation system can use only part of the information available (for example, under level 1, rate-of-turn indicators do not use information on vessel crossing). The response to the navigational environment includes the radiocommunication with boatmasters of other vessels.

Your comments and proposals are welcome

Please send your written contributions to Mr Benjamin Boyer, Technical Administrator, CCNR, b.boyer@ccr-zkr.org

	Level	Designation	Vessel command (steering, propulsion, wheelhouse, ...)	Monitoring of and responding to navigational environment	Fallback performance of dynamic navigation tasks	Remote control
Boatmaster performs part or all of the dynamic navigation tasks	0	No automation the full-time performance by the human boatmaster of all aspects of the dynamic navigation tasks, even when enhanced by warning or intervention systems <i>E.g. navigation with support of radar installation</i>				No
	1	Steering assistance the context-specific performance by a <u>steering automation system</u> using certain information about the navigational environment and with the expectation that the human boatmaster performs all remaining aspects of the dynamic navigation tasks <i>E.g. rate-of-turn regulator</i> <i>E.g. trackpilot (track-keeping system for inland vessels along pre-defined guiding lines)</i>				
	2	Partial automation the context-specific performance by a navigation automation systems of <u>both steering and propulsion</u> using certain information about the navigational environment and with the expectation that the human boatmaster performs all remaining aspects of the dynamic navigation tasks				
System performs the entire dynamic navigation tasks (when engaged)	3	Conditional automation the sustained context-specific performance by a navigation automation system of all dynamic navigation tasks, <u>including collision avoidance</u> ¹ , with the expectation that the human boatmaster will be receptive to requests to intervene and to system failures and will respond appropriately				Subject to context specific execution, remote control is possible (vessel command, monitoring of and response to environment or fallback performance). It may have an influence on crew requirements (number or qualification)
	4	High automation the sustained context-specific performance by a navigation automation system of all dynamic navigation tasks <u>and fallback operation, without expecting a human boatmaster responding to a request to intervene</u> ² <i>E.g. vessel operating on a canal section between two successive locks (environment well known), but the automation system is not able to manage alone the passage through the lock (requiring human intervention)</i>				
	5	Full automation the sustained and <u>unconditional</u> performance by a navigation automation system of all dynamic navigation tasks and fallback operation, without expecting a human boatmaster will respond to a request to intervene				

¹ "Collision avoidance" is the critical task in responding to the environmental conditions (other vessels, bridges,...).

² This level introduces two different functionalities: the ability of "normal" operation without expecting human intervention and the exhaustive fallback. Two sub-levels could be envisaged.