

## TELEOPERATION AS A KEY ENABLER FOR CONNECTED AND AUTOMATED DRIVING (CAD)

Paving the way for future mobility, the teleoperation of connected and automated vehicles (CAV, SAE 4) represents an approach that effectively leverages the benefits of automated driving while full autonomy is not yet a reality. Safety and reliability are ensured by having a teleoperator as a remote assistant who can support the vehicle remotely and provide guidance in the event of challenges to the driving task that exceed the capabilities of the vehicle automation system. The technology comes with technical, legal and human factors challenges. From a technical perspective, the most pressing issues are latency in data transmission and other issues of connectivity. The legal framework in many EU countries, including Germany, clears the way for remote operation as remote assistance while heavily restricting remote driving. From a Human Factors perspective, situation awareness,

telepresence, vigilance, task balance, and workload are crucial concepts that need to be considered when designing for teleoperation. To meet these challenges, a novel human-machine interface (HMI) for the teleoperation of CAVs was developed supported by user-centered methods in iterative steps and evaluated. Results showed that even under elevated induced workload, participants were able to construct sufficient situation awareness and resolve the CAVs' requests for assistance successfully in typical scenarios. The workplace HMI was rated positively overall, especially with regard to usability and acceptance. The study provided valuable information for the iterative further development of the HMI design. Teleoperation may be a viable approach to defragmenting Operational Design Domains (ODD) by using human information processing skills.

### The prototypical workplace for teleoperating CAVs at DLR's Institute of Transportation Systems





## A teleoperator using the prototypical workplace for teleoperating CAVs at DLR's Institute of Transportation Systems

Envisioning teleoperation as a system with multiple actors and links is a valuable asset of DLR's Institute of Transportation Systems. Research groups investigate teleoperation holistically across a wide range of research areas, i.e., the system and service design of a socio-technical system. For instance, not only the teleoperator's workplace is being developed here but so are the automation for CAD, the intelligent infrastructure that can support both CAVs and teleoperators, and the data links between all those actors.

### CONTACT

German Aerospace Center (DLR)  
Institute of Transportation Systems  
Lilienthalplatz 7  
38108 Braunschweig  
Germany

Andreas Schrank, M.Sc.  
andreas.schrank@dlr.de  
Telephone +49 531 295 1015

Dr. Michael Oehl  
michael.oehl@dlr.de  
Telephone +49 531 295 2035

### PROJECT FACTS

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Timeline July 2021 – June 2025 | Project coordinator Aria Etemad, Volkswagen Group Innovation,  
aria.etemad@volkswagen.de | LinkedIn company/hi-drive | Twitter @\_HiDrive\_ | www.hi-drive.eu



### PARTNERS



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