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<b>Title of presentation</b> A prototype to develop and evaluate remote control workplaces for future automated railway operation	<b>Institution</b> German Aerospace Center (DLR e.V.)
<b>Please highlight workshop topic(s) your paper is relevant for</b> <input type="checkbox"/> <b>Automation, Train control systems</b>	
<b>Abstract</b> <p>The train operator is a member of staff that is automatically requested by automated trains without onboard staffing to remotely diagnose or manually drive any train in a particular area, once the ATO functionality reaches its limits or disruptions occur. The task environment of a train operator comprises tasks that are not necessarily related to a particular train (e.g. communication, planning, or monitoring the traffic in the area) and tasks that come up after manual intervention is requested by a particular train in cases of irregularity (e.g. on- sight driving, speed adjustment, communication with passengers, or diagnosis). At the German Aerospace Center, we developed a prototypical workplace environment for the future train operator. First usability ratings from professional train drivers showed a positive evaluation of the systems usefulness but also additional information needed by the train operator. These additional sources of information and also results regarding workload and intuitive usability were incorporated in a second design iteration of the prototype.</p> <p>Apart from further developing the graphical user interface, several functionalities were included in the second iteration. To heighten the fidelity of the prototype and future studies, vigilance control technology commonly known as the dead man´s switch, was implemented along with the possibility to implement operational scenarios in which multiple train operators work collectively in a particular area. Thus, we are now able to gain more insights into the team aspects (e.g. distraction, group think) of centralized remote control within an operational center. Furthermore, the second iteration of the prototype features built-in interfaces for online evaluation of key performance indicators on operational quality (such as total delay or spread of delays across the particular area) as well as initial technology upgrade costs that allow cost-benefit analyses for specified operational scenarios taking into account the initial investments against a benchmark scenario (e.g. the current operational environment on a certain track).</p> <p>The second iteration remote workplace prototype enables studying future automated railway operations beyond the routine scenarios by providing one vision for coping with corner cases and cases of disruptions. This broad range of scenarios can be evaluated inclusively from human factors, operational and monetary points of view.</p> <p>This simulation environment can contribute to answer the most urgent question around remote control in automated railway operations that relate to a) operational safety and human performance b) identifying operational scenarios and corner cases in which remote control can be of incremental value to an automated railway system.</p>	