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**Title of presentation**

The development of a joint cognitive system of train driver and ATO GoA2 at Netherlands Railways

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**Please highlight workshop topic(s) your paper is relevant for**

- ☐ **Automation, Train control systems**
- ☐ **Situation awareness**
- ☐ **Human Factors Integration (e.g., in organizational processes)**

## Abstract

Our GoA2 journey starts with testing an off-the-shelf product for ETCS. For us it was designed according to the classical left-over principle – where as much as feasible is automated, while the rest is left over for the operator. In this phase we observed the man-machine-interaction (MMI) by plotting moments where the driver takes over from automatic train operation (ATO) or tends to do so in so-called driver journeys. We installed cameras to be able to reflect on situations during the test drives. We found out that the driver journey is a good instrument to analyse the MMI between driver and ATO. We reconstructed the evolution of trust in ATO over ETCS using different situations of trust dampening and repair. We performed Human Factors experiments to investigate the driver's assessment in case of unexpected situations with ATO. We learned that the information of ATO to the driver was not enough to detect these situations in time and be able to act properly.

Since the beginning of this year, we have been developing GoA2 for our class-B system. We approached the development of the joint interaction between ATO and the driver from a function-oriented principle (Hollnagel, 2003). The first step was to design the MMI in such a way that the desired performance was achieved: maximize capacity usage, provide a safe and comfortable journey, and minimize take-overs by the driver. The ATO DMI was then developed based on the information needs that came from the MMI design. Next, we performed design experiments in our train driver simulator with various stages of the developed GoA2 DMI solution. The drivers involved were very enthusiastic about their involvement in the development and the early learnings enhanced the maturity and direction of the GoA2 solution positively. Currently, we are initiating practice tests of the GoA2 solution over our Class-B system. Since we now have a blueprint of the MMI, we were able to train the drivers in their monitoring task, which increased trust in ATO at the start of the tests.

Our concluding remarks are that involving a man-machine-interaction perspective from the start of GoA2 development results in a better joint cognitive system performance and a more positive attitude of involved train drivers towards the development of ATO.