



Safety recommendation no. 169

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Safety deficit	<p>In an encounter involving two steamships in the Lucerne lake basin on Lake Lucerne on 19 August 2016 at approximately 13.35, the steamship Unterwalden (DS Unterwalden) suddenly veered to the left and so collided side-on with the steamship Schiller (DS Schiller).</p> <p>The collision between the DS Unterwalden and the DS Schiller in the Lucerne lake basin was due to the fact that the rudder deflection to port could not be corrected in time when two steering commands were given almost simultaneously at two control stands. The rudder steering software was programmed to continue carrying out the first command received even after further commands had been given by another control signal transmitter.</p> <p>The following contributed to the accident:</p> <ul style="list-style-type: none">• A requirements and testing process that did not describe precise specifications for the functionality and testing of the software and did not explicitly exclude undesirable states.• The Failure Mode and Effects Analysis FMEA did not cover a steering failure, software error or operational error or their impact on operational safety in different situations.• The lack of clear behaviours or procedures for the handover or takeover of the different control stands led to several control signal transmitters operating at the same time. <p>The following helped to reduce the impact: The initiation of an emergency manoeuvre (emergency stop – engines 'full back') by the crew reduced the impact of the collision.</p> <p>The following factors did not contribute to the accident, but were identified in the investigation as potential areas in which safety improvements can be made:</p> <ul style="list-style-type: none">• The design of the control signal transmitters poses risks to operational safety as there are no emergency running properties in the event of conceivable defects in the switch element and insufficient protection against moisture.• No shielded cables were used to transmit the control signals from the control signal transmitters in the control stands to the PLC in the aft peak.• The control signals from the control signal transmitters in the three control stands are electrically connected in parallel and received via two digital inputs in the PLC. This means the control commands from the control stands cannot be separately evaluated in the PLC, pending commands cannot be prioritised and control processes cannot be seamlessly traced.• Since computer-based control processes are not stored, they cannot be traced; if this were the case, it would be easier to understand the control processes in the event of an incident.

The Failure Mode and Effects Analysis FMEA only covered the technical failure of component groups or individual components. It did not cover faults and effects that may have resulted from operation or external influences. Likewise, it did not cover faulty behaviour of the PLC or the software. Nor was the effect of the interaction of component failures and subsequent operator reactions on operational safety in different situations (docking, full speed, braking manoeuvres, etc.) considered. This deficiency was not identified when the FOT checked the FMEA in the planning approval procedure.

Safety recommendation	The Federal Office of Transport (FOT) should raise awareness in the inland navigation sector that an FMEA should also take into account the effects of both computer-based control failures and operator errors. The FOT should then check these points in the FMEA in the planning approval process.
Addressees	Bundesamt für Verkehr
Stage of the implementation	Partially implemented. The Federal Office of Transport (FOT) confirms that under the revised Implementing Provisions to the Shipbuilding Ordinance (IP-ShipBO), an FMEA for rudder systems will be required to include consideration of the effects of failures of computer-based controls and of operational errors. The revised version of the IP-ShipBO is due to come into force in spring 2023. Under the revised ordinance, this aspect will be examined in the planning approval process.
Investigation report concerning the safety recommendation	<u>Schlussbericht</u> <u>Vorbericht</u>