

Development of cognitive digital twin-aided emergency response and rescue systems for Matsya6000

M. Palaniappan, N. Vedachalam, C. Jothi, Tamshuk Chowdhury, V. Bala Naga Jyothi and Dhinesh Ganapathy

Ensuring human safety is the key requirement for deep-ocean human-occupied scientific submersibles operating in remote, extreme environments. Even though human-rating standards are followed to reduce the failure of life-critical systems of Matsya6000 to as-low-as-reasonably-achievable, mechanisms should be in place to manage the residual risks. The present article describes the strategies adopted for reliability and safety-centred design of mission-critical and life-critical systems, design and development of a human-rated emergency rescue system (ERS) for Matsya6000, comprising a location marker cum rescue buoy, on-demand actuator release mechanism and situation-aware cognitive digital twin Chaitanya for proactive crew decision-support during energy-rationed emergency period. The location marker buoy is tested by releasing it from a 500 m water depth in the Bay of Bengal, and the time-to-surface was found to comply with the numerical simulation results with an accuracy of 90%, and the Chaitanya performance in predicting the last-time-to-actuate the ERS was found to have an accuracy of $\sim 97\%$.