FSRs unfulfilled by the technical architecture of i-CAVE demonstrator and safety tactics and patterns to address them

Functional architecture component	Functional Safety Requirement	Applicable Safety Tactics	Applicable Safety Patterns
Actuation Sensor	A failure in Actuation Sensor shall not cause incorrect sensor information	Sanity Check Condition Monitoring Comparison Repair Degradation Override Masking	Sanity Check Pattern Monitor-Actuator Pattern Protected Single Channel Pattern
Actuator	Corruption of signals to Actuator shall not interfere with the correct working of actuators	Simplicity Substitution Sanity Check Condition Monitoring Diverse Redundancy Redundancy Repair Voting Masking Override	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern Sanity Check Pattern Monitor-Actuator Pattern Protected Single Channel Pattern
Environment Perception Sensors	Incorrect information going into Environment Perception Sensors shall not cause known perception information to be incorrect as well	Sanity Check Comparison Diverse Redundancy Redundancy Voting Masking Override Barrier Heartbeat	M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern N-Self Checking Programming Pattern Sanity Check Pattern Watchdog Pattern
Host Tracking	A failure in Host Tracking shall not cause incorrect self-tracking	Sanity Check Condition Monitoring Comparison Diverse Redundancy Redundancy Repair Degradation Voting Masking Override Heartbeat Rollback	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern Recovery Block Pattern N-Self Checking Programming Pattern Sanity Check Pattern Monitor-Actuator Pattern Watchdog Pattern Safety Executive Pattern Protected Single Channel Pattern 3-Level Safety Monitoring Pattern
Sensor Fusion (Vehicle State Estimator, Host Tracking, Target Tracking)	A failure in Sensor Fusion shall not cause incorrect interpretation of raw sensor data	Simplicity Sanity Check Condition Monitoring Comparison Diverse Redundancy Redundancy Replication	Homogenous Duplex Pattern Heterogenous Duplex Pattern Triple Modular Redundancy Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern

		Redundancy Repair Degradation Voting Masking Override Rollback	Recovery Block Pattern N-Self Checking Programming Pattern Sanity Check Pattern Monitor-Actuator Pattern Protected Single Channel Pattern
Sensor Fusion (Vehicle State Estimator, Host Tracking, Target Tracking)	Corruption of signals from Sensor Abstraction to Sensor Fusion shall not interfere with the correctness of data provided to Sensor Fusion	Sanity Check Condition Monitoring Comparison Diverse Redundancy Redundancy Repair Voting Masking Override	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern N-Self Checking Programming Pattern Sanity Check Pattern Monitor-Actuator Pattern Protected Single Channel Pattern
Target Tracking	A failure in Target Tracking shall not cause it to not track a vehicle that shall be tracked	Condition Monitoring Diverse Redundancy Redundancy Repair Degradation Override Masking Heartbeat	Heterogenous Duplex Pattern M-out-of-N-D Pattern Monitor-Actuator Pattern
Target Tracking	A failure in Target Tracking shall not cause it to track a vehicle that shall not be tracked	Condition Monitoring Diverse Redundancy Redundancy Repair Override Masking Barrier	Heterogenous Duplex Pattern M-out-of-N-D Pattern Monitor-Actuator Pattern
V2V Communication	Corruption of signals of Vehicle Control to V2V shall not interfere with the correctness of information at V2V Communication	Simplicity Substitution Sanity Check Condition Monitoring Diverse Redundancy Redundancy Repair Voting Masking Override	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern Sanity Check Pattern Monitor-Actuator Pattern Protected Single Channel Pattern
V2V communication	Incorrect arrival of V2V signals at a V2V station shall not interfere with the correct of information at another V2V station	Simplicity Sanity Check Condition Monitoring Comparison Replication Redundancy Redundancy Repair Degradation Voting Masking Override	Homogenous Duplex Pattern Triple Modular Redundancy Pattern M-out-of-N Pattern M-out-of-N-D Pattern Sanity Check Pattern Monitor-Actuator Pattern Watchdog Pattern Safety Executive Pattern Protected Single Channel Pattern 3-Level Safety Monitoring Pattern

		Barrier Heartbeat	
V2V Communication	A failure in V2V shall not cause incorrect information to be sent to other vehicles	Condition Monitoring Repair Override Masking Barrier Rollback	Monitor-Actuator Pattern
V2V Communication	Incorrect information going into V2V shall not cause known information about other vehicles to be incorrect	Sanity Check Comparison Replication Redundancy Redundancy Voting Masking Override Barrier Heartbeat	Triple Modular Redundancy Pattern M-out-of-N Pattern M-out-of-N-D Pattern Sanity Check Pattern Watchdog Pattern
Vehicle Control	Corruption of signals from V2V to Vehicle Control shall not interfere with the correctness of data provided to Vehicle Control from V2V	Simplicity Substitution Sanity Check Condition Monitoring Diverse Redundancy Redundancy Repair Voting Masking Override	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern Sanity Check Pattern Monitor-Actuator Pattern Protected Single Channel Pattern
Vehicle Control	A failure in Vehicle Control shall not cause lack of generation of required signals	Simplicity Substitution Sanity Check Condition Monitoring Diverse Redundancy Redundancy Repair Degradation Voting Masking Override Rollback	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern Recovery Block Pattern Sanity Check Pattern Monitor-Actuator Pattern Protected Single Channel Pattern
Vehicle Control	A failure in Vehicle Control shall not cause generation of improper control setpoints	Simplicity Substitution Sanity Check Condition Monitoring Comparison Diverse Redundancy Redundancy Repair Degradation Voting Masking Override Barrier Rollback	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern Recovery Block Pattern N-Self Checking Programming Pattern Sanity Check Pattern Monitor-Actuator Pattern Protected Single Channel Pattern

Vehicle Control	A failure in Vehicle Control shall not cause the lack of generation of control setpoints	Condition Monitoring Diverse Redundancy Redundancy Repair Degradation Voting Masking Override Heartbeat Rollback	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Monitor-Actuator Pattern
Vehicle Control	A failure in Vehicle Control shall not cause the control mode (platooning or manual driving) to remain the same while it shall be changed	Simplicity Condition Monitoring Diverse Redundancy Redundancy Repair Voting Masking Override Heartbeat	Heterogenous Duplex Pattern M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Monitor-Actuator Pattern
Vehicle State Estimator	A failure in Vehicle State Estimator shall not cause the known vehicle state to be incorrect	Sanity Check Condition Monitoring Diverse Redundancy Redundancy Repair Degradation Voting Masking Heartbeat Rollback	M-out-of-N Pattern M-out-of-N-D Pattern N-Version Programming Pattern Acceptance Voting Pattern